Nokia Customer Care

Service Manual

RH-116; RH-117 (Nokia 7070 prism)

Mobile Terminal

Part No: 9210680 (Issue 1)

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COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	06/2008	Jeff Zhao	

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IMPORTANT

This document is intended for use by qualified service personnel only.

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Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

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For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

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Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

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ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

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Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

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Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Nokia 7070 prism Service Manual Structure

1 General Information
2 Service Tools and Service Concepts
3 Baseband Troubleshooting Instructions
4 RF Troubleshooting Instructions
5 System Module
Glossary

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1 — General Information

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RH-116/RH-117 product selection

The RH-116 is the EU version of the telephone with a dual band transceiver unit designed for the GSM900 and GSM1800 networks.

The RH-117 is the US version of the telephone with a dual band transceiver unit designed for the GSM850 and GSM1900 networks.

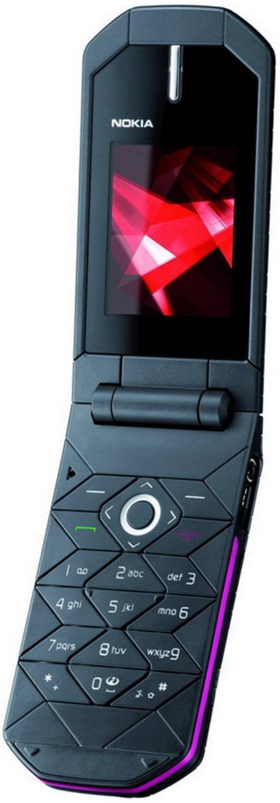

Figure 1 RH-116/RH-117 product picture

Features

Hardware features

- Fold with internal antenna
- GSM dualband 900/1800 for Europe, MEA, China, APAC and LTA·
- GSM dualband 850/1900 for LTA/NA
- Display: True (65,536) color active high resolution display 128x160 (active area 1.8”)
- Codecs: HR, FR, EFR and AMR
- Integrated hands free speaker
- Easy flash II system connector
- Ringing volume: 95 phon from 10cm distance
- Built-in Vibra
- GPRS rel-4, class B, GPRS MSC10
- EGPRS MSC6

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Software features

- OS: ISA
- UI Style: S40
- MIDP 2.0 Java, with latest APIs
- Browser: XHTML over TCP/IP (WAP 2.0 compliant)
- MMS 1.2

UI features

- Douglas V UI style with 5-way scroll
- Nokia Series 40 user interface
- MP3 ringing tones & 24 polyphonic ringing tones
- Themes, colour games and wall papers
- Java games (downloadable)
- To-do list and Notes
- Countdown timer
- Phonebook image
- Menu with animated icons
- 2 font sizes are supported in the editor
- Calendar in day/week/month view
- Chinese lunar Calendar II (not for all regions)

Mobile enhancements

Table 1 Power

Type	Name
BL-4B	Battery 700 mAh Li-Ion
AC-3	Compact charger
AC-4	Travel charger
AC-5	Compact travel charger
CA-44	Charger adapter
DC-4	Mobile charger

Table 2 Car

Type	Name
CK-15W	Display car kit
CK-20W	Multimedia car kit
CK-25W	Multimedia car kit

Table 3 Audio

Type	Name
HS-38W	Nokia bluetooth headset BH-202
HS-40	Headset
HS-47	Stereo headset
HS-50W	Nokia bluetooth headset BH-300
HS-51W	Nokia bluetooth headset BH-301
HS-52W	Nokia bluetooth headset BH-201
HS-58W	Nokia bluetooth headset BH-200
HS-68W	Nokia bluetooth headset BH-203
HS-73W	Nokia bluetooth headset BH-302
HS-78W	Nokia bluetooth headset BH-100
HS-79W	Nokia bluetooth headset BH-303
HS-80W	Nokia bluetooth headset BH-208
HS-84W/88W	Nokia bluetooth headset BH-204
HS-85W	Nokia bluetooth headset BH-206
HS-86W	Nokia bluetooth headset BH-207
MD-4	Mini speakers

Technical specifications

General specifications

Unit	Dimension LxWxT (mm)	Weight (g)	Volume (cc)
Transceiver with BL-4B 700mAh Li-Ion battery pack	87.5x44x15.8	78	52

Battery endurance

Nokia measurements of operation times in GSM900/1800

Talk time	
Battery: BL-4B 700mAh	5 h

Standby time	
Battery: BL-4B 700mAh	416 h

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Note: Variation in operation times will occur depending on SIM card, network settings and usage. Talk time is increased by up to 30% if half rate is active and reduced by 5% if enhanced full rate is active.

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15 ºC ... +55 ºC	Specifications fulfilled
Reduced performance	-30 ...15 ºC and +55ºC ... +70 ºC	Operational only for short periods
Intermittent or no operation	-40 ºC ... -30 ºC and +70 ºC ... +85ºC	Operation not guaranteed but an attempt to operate will not damage the phone
No operation or storage	<-40 ºC and >+85 ºC	No storage. An attempt to operate may cause permanent damage
Charging allowed	-15 ºC ... +55 ºC	
Long term storage conditions	0 ºC ... +85 ºC	
Humidity and water resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented in (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

Electrical characteristics

Table 4 Normal and extreme voltages

Voltage	Voltage (V)	Condition
General conditions		
Nominal voltage	3.90V	a
Lower extreme voltage	3.30V	b
Higher extreme voltage	4.30V	c
HW shutdown voltages		
Vmstr+	2.1V ± 0,1V	Off to on
Vmstr-	1.9V ± 0,1V	On to off
SW shutdown voltages		
SW shutdown	3. 1V	In call
SW shutdown	3. 2V	In idle

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Min operating voltage		
Vcoff+	3. 1V ± 0,1V	Off to on
Vcoff-	2. 8V ± 0,1V	On to off

HW reset demands		
Min	1. 0V	d
Max	--	

a. The nominal voltage is defined as being 15% higher than the lower extreme voltage. TA will test with this nominal voltage at an 85% range (0.85x3.9V ª 3.3V).

b. This limit is set to be above SW shutdown limit in TA.

c. During fast charging of an empty battery, this voltage might exceed this value. Voltages between 4.20 and 4.60 might appear for a short while.

d. The minimum battery cell voltage required for the reset circuitry to turn on. This is not confirmed by measures at pt.

Table 5 Current consumption

Condition	Min	Typical	Max	Unit
Call (MoU) (E)GSM 900 GSM 1800 GSM 1900		244 173 168		mA
Idle (MoU)		1.68		mA
Power off	150		250	mA

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2 — Service Tools and Service Concepts

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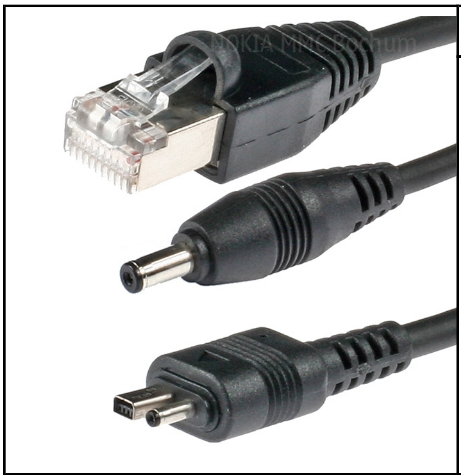
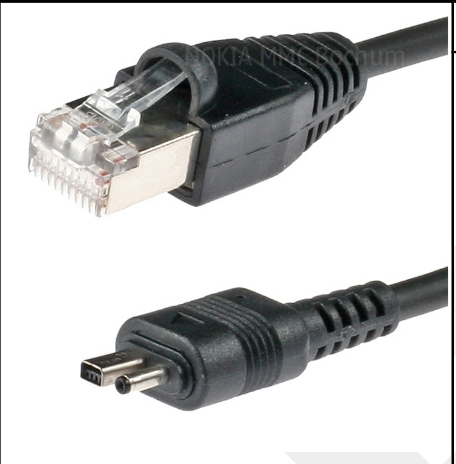
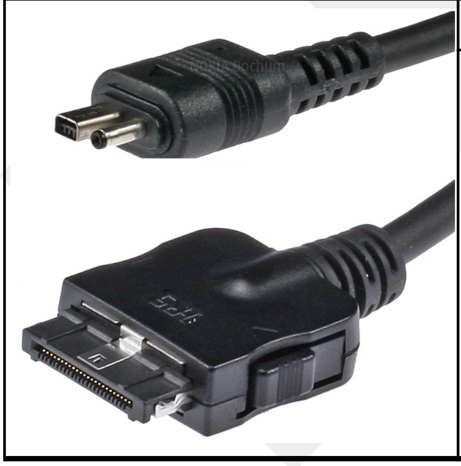
Service Tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RH-116; RH-117. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2"></td><td>CA-106DS</td><td>Easy flash II cable</td><td></td></tr>
<tr><td colspan="3">The cable is used for connecting phone DC port to the flash prommer FPS-10.</td></tr>
<tr><td rowspan="2"></td><td>CA-111DS</td><td>Easy flash II cable</td><td></td></tr>
<tr><td colspan="3">The cable is used for connecting phone DC port to either POS flashing device FLS-4S or to the PROMMER box FPS-11.</td></tr>
<tr><td rowspan="2"></td><td>CA-112DS</td><td>Easy flash II cable</td><td></td></tr>
<tr><td colspan="3">The CA-112DS easy flash II cable is used for connecting phone DC port to the PROMMER facilities (FLS-5, FPS-20).</td></tr>
</table>

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CA-128RS	CA-128RS	RF Cable	
	This RF cable is used together with MJ-167 to connect to RF measurement equipment.		
	CA-41PS	Power cable	
	Power cable for connection of e.g. the JBV-1 docking station to the FPS-10 prommer box.		
	CA-52PS	DC Cable	
	The cable is used to connect JBV-1 docking station to the phone charger jack for ADC/VCHAR/ICHAR calibration.		
	DA-72	Docking station adapter	
	The docking station adapter is used for this phone in combination with JBV-1. The adapter supports flashing and energy management calibration, Features include: • compatible with JBV-1 • easy phone attachment and detachment • reliable phone locking • switch for detecting phone • replaceable SIM interface		

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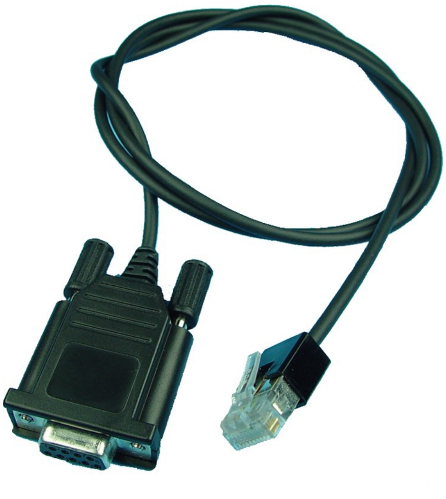
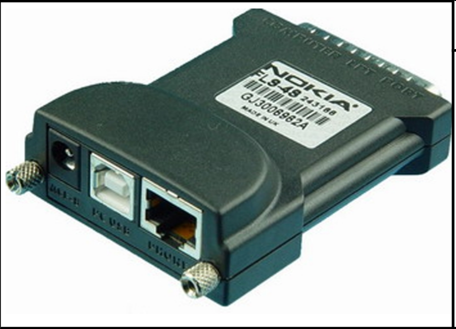
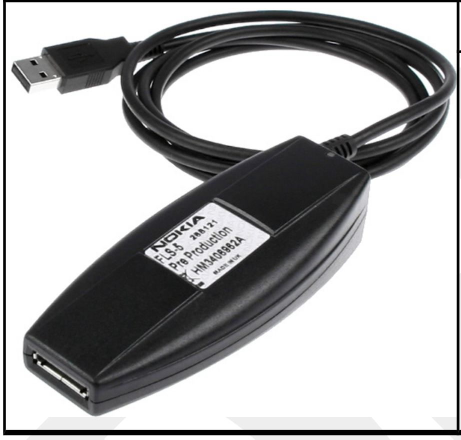
	DAU-9S	MBUS cable	
	The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters. **Note:** Docking station adapters valid for DCT4 products.		
	FLS-4S	Flash device	
	FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.		
	FLS-5	Flash device	
	FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use. **Note:** FLS-5 can be used as an alternative to PKD-1.		

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FPS-10 | **Flash prommer**

FPS-10 interfaces with:

- PC
- Control unit
- Flash adapter
- Smart card

FPS-10 flash prommer features:

- Flash functionality for BB5 and DCT-4 terminals
- Smart Card reader for SX-2 or SX-4
- USB traffic forwarding
- USB to FBUS/Flashbus conversion
- LAN to FBUS/Flashbus and USB conversion
- Vusb output switchable by PC command

FPS-10 sales package includes:

- FPS-10 prommer
- Power Supply with 5 country specific cords
- USB cable

Note: FPS-21 is substitute FPS-10 if FPS-10 has not been set up.

JBV-1 | **Docking station**

The JBV-1 docking station is a general tool that has been designed for calibration and software update use. The JBV-1 is used together with a docking station adapter as one unit

In calibration mode the JBV-1 is powered by an external power supply: 11-16V DC. When flashing the power for the phone must be taken from the flash prommer.

Note: JBV-1 main electrical functions are:

- adjustable VBATT calibration voltage, current measurement limit voltage: VCHAR, current measurement: ICHAR
- adjustable ADC calibration voltage via BTEM and the BSI signal
- BTEMP and BSI calibration resistor
- signal from FBUS to the phone via the parallel jig
- control via FBUS or USB
- Flash OK/FAIL indication

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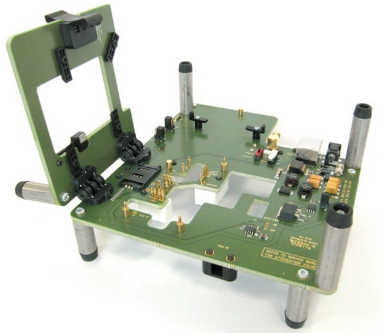

MJ-167	Module jig	

MJ-167 is meant for component level troubleshooting.

The jig includes an RF interface for GSM and Bluetooth. in addition, it has the following features:

- Provides mechanical interface with the engine and UI module
- Provides galvanic connection to all needed test pads in module
- Duplicated SIM connector
- Audio components: IHF, MIC
- Connector for control unit

Note: CA-128RS(RF cable) is used together with MJ-167. CA-128RS is not a part of the MJ-167 sales package and has to be ordered separately.

The following table shows the attenuation values for MJ-167:

Frequency (Hz)	Loss (dB)
836600000	0.24
881600000	0.24
897400000	0.25
942400000	0.25
1747800000	0.35
1842800000	0.37
1880000000	0.38
1950000000	0.40
1960000000	0.40
2140000000	0.40

PCS-1	Power cable	

The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.

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<table>
<tr><td rowspan="2"> </td><td>PK-1</td><td>Software protection key</td><td></td></tr>
<tr><td colspan="3">PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.
PK-1 is meant for use with a PC that does not have a series interface.
To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</td></tr>
<tr><td rowspan="2"> </td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-230</td><td>Soldering jig</td><td></td></tr>
<tr><td colspan="3">The jig is used for soldering and as a rework jig for the system module. It is made of lead-free rework compatible material.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-51</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">To be used with ST-30!</td></tr>
<tr><td rowspan="2"> </td><td>RJ-72</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">To be used with rework stencil ST-28.</td></tr>
</table>

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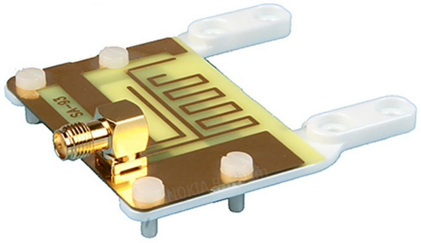


SA-93	RF coupler	

The coupler is used for Go/No-Go test after changing components in the RF part of the phone.

It is mounted on the docking station adapter.

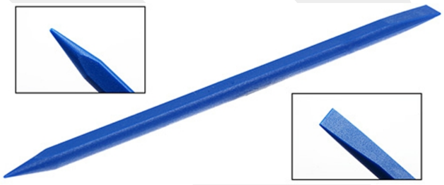
The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-93:

Band	Tuning channel	Attenuation RX (dB)	Attenuation TX(dB)
GSM850	128	14	10.2
	190	15	9.6
	251	14	9.7
GSM900	38	7	9.2
	124	10	8.3
	975	9	9.5
GSM1800	512	6	10.1
	700	6	8.6
	885	6	7.3
GSM1900	512	6	6.6
	661	6	6.1
	810	7	5.3

SS-6	Opening tool	

SS-6 is used for removing the upper part from the lower part..

> **Caution:** Handle the tool with care because the tip is only 0.7 mm in diameter.
>
> When not in use, store in a safe location.



SS-93	Opening tool	

SS-93 is used for opening JAE connectors.

ST-28	rework stencil	

This stencil is used together with RJ-72 to rework N7600.

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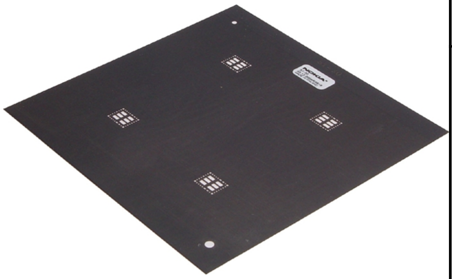
<table>
<tr><td rowspan="2"></td><td>ST-30</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">It is used together with RJ-51 to rework the Front End Module (FEM) N7700.</td></tr>
<tr><td rowspan="2"> </td><td>SX-4</td><td>Smart card</td><td></td></tr>
<tr><td colspan="3">SX-4 is a BB5 security device used to protect critical features in tuning and testing.
SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</td></tr>
<tr><td rowspan="2"> </td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
<tr><td rowspan="2"> </td><td>XRS-6</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector approximately 610 mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WLAN: 0.6+-0.1dB</td></tr>
</table>

DRAFT

Service concepts

POS flash concept with FLS-4S

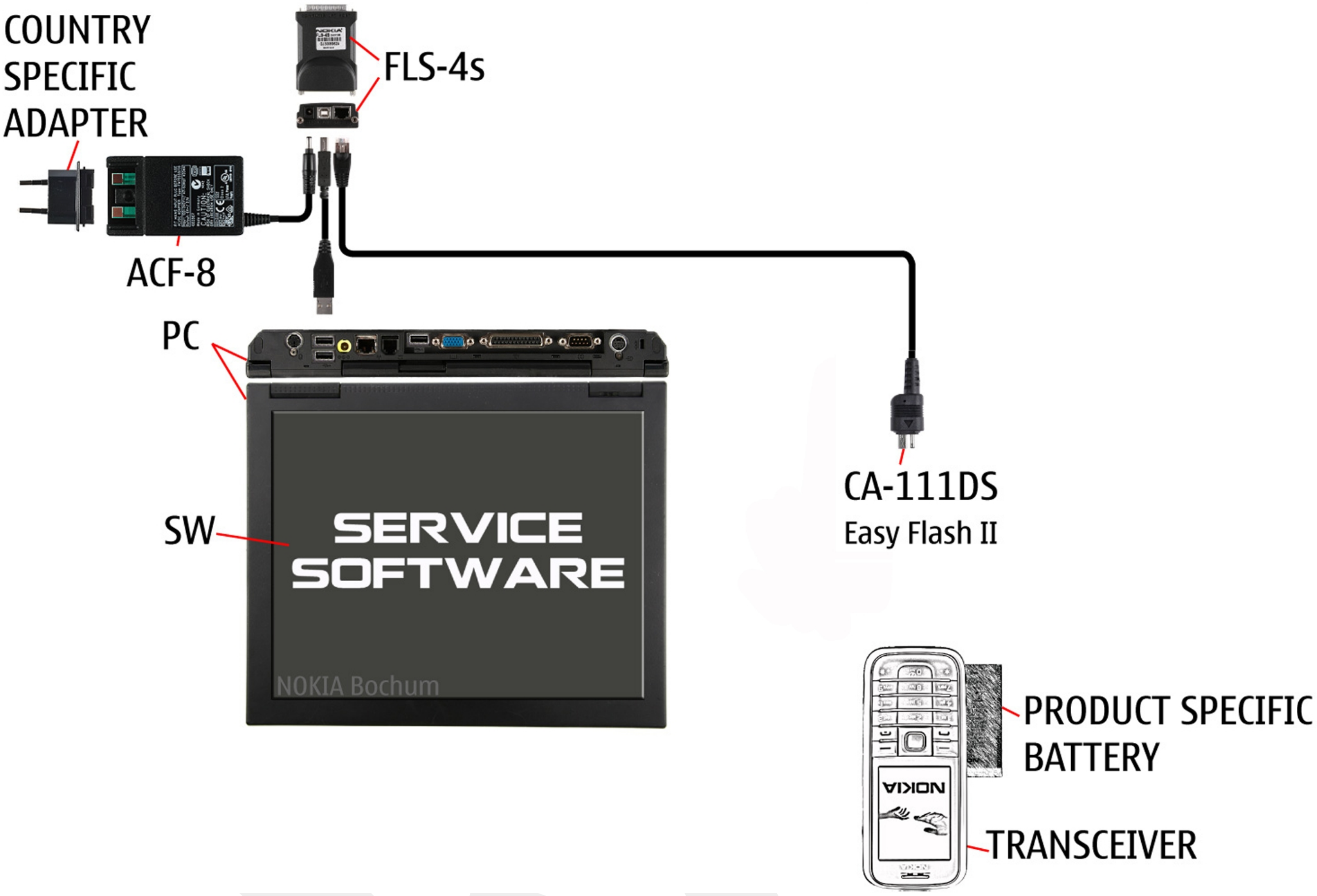

COUNTRY SPECIFIC ADAPTER
FLS-4s
ACF-8
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
CA-111DS
Easy Flash II
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Figure 2 POS flash concept with FLS-4S

DRAFT

POS flash concept with FLS-5

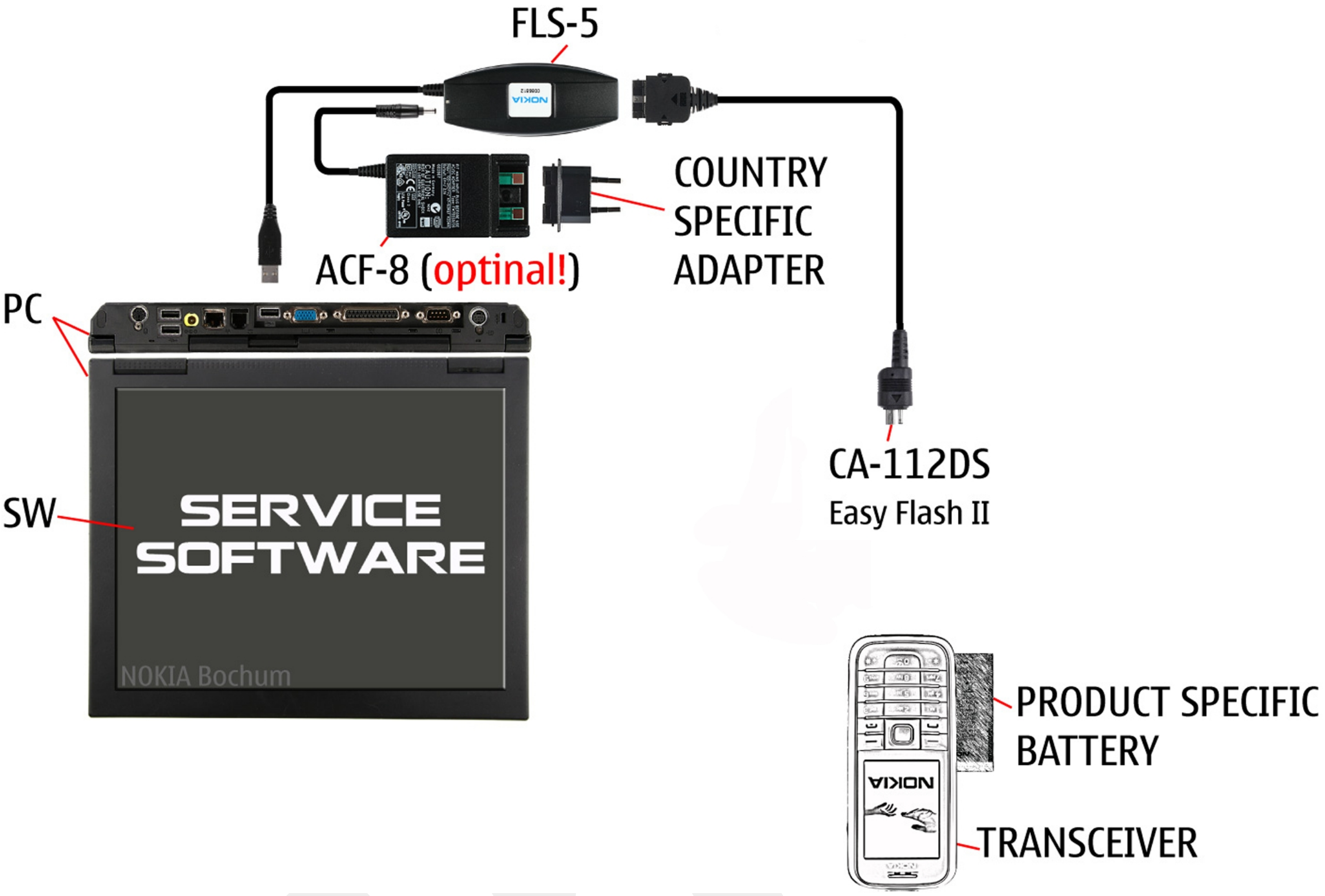

FLS-5
COUNTRY SPECIFIC ADAPTER
ACF-8 (optinal!)
PC
SW
SERVICE SOFTWARE
NOKIA Bochum
CA-112DS
Easy Flash II
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Figure 3 POS flash concept with FLS-5

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Flash concept with FPS-10

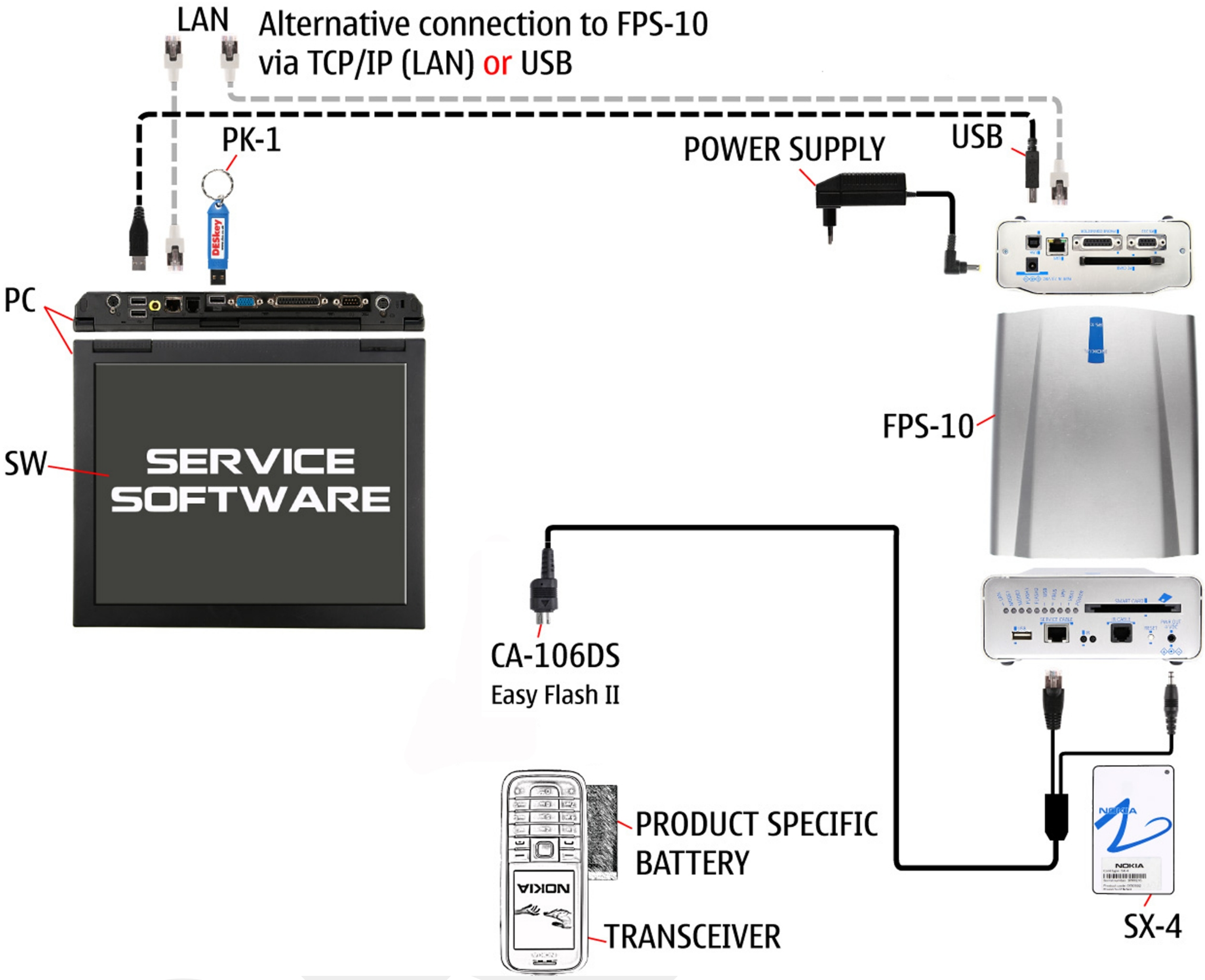
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
PK-1
POWER SUPPLY
USB
PC
SW
SERVICE SOFTWARE
FPS-10
CA-106DS
Easy Flash II
PRODUCT SPECIFIC
BATTERY
TRANSCEIVER
SX-4

Figure 4 Flash concept with FPS-10

RF-test/BB-tune concept with JBV-1

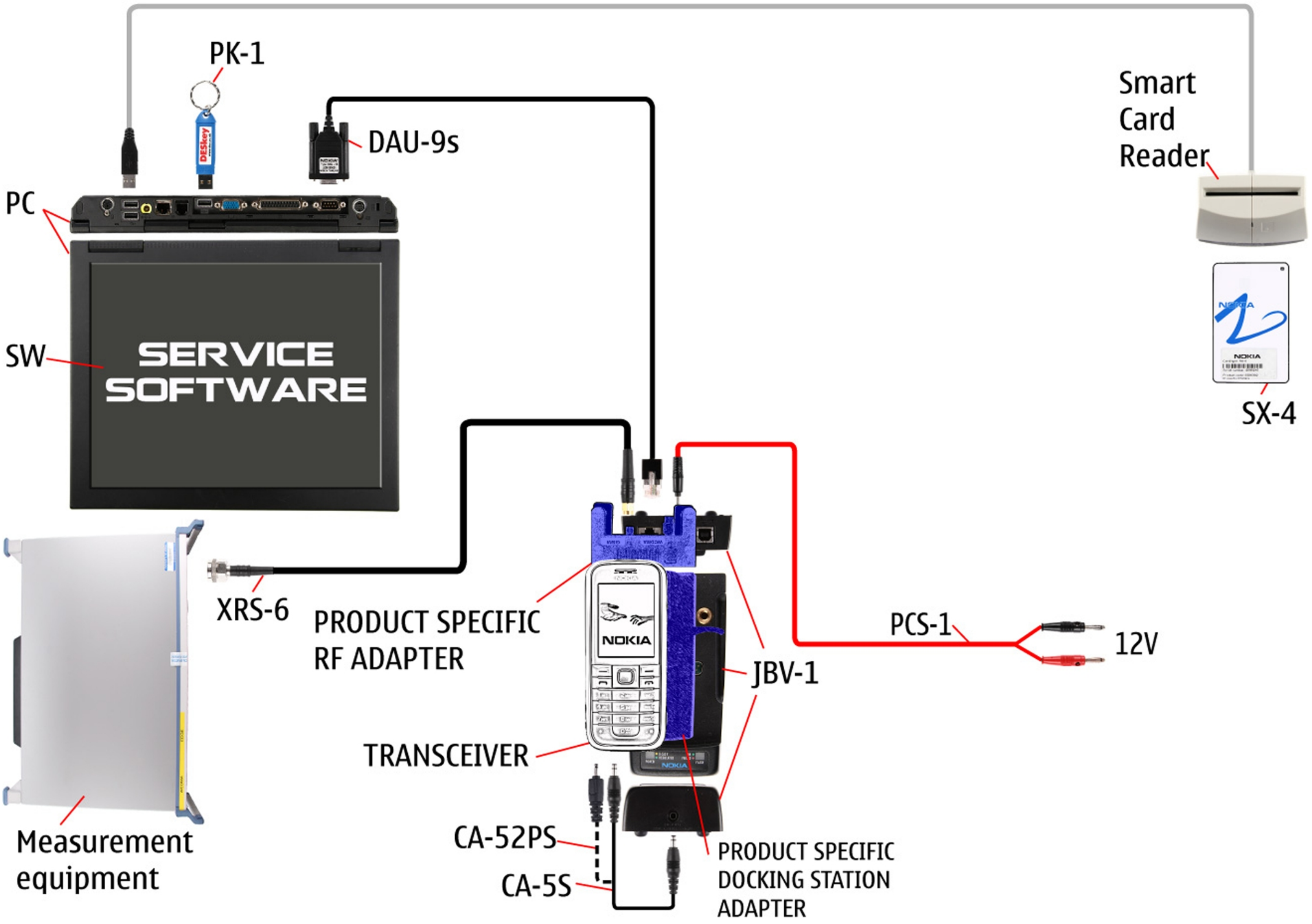
PK-1
DAU-9s
Smart
Card
Reader
PC
SW
SERVICE
SOFTWARE
SX-4
XRS-6
PRODUCT SPECIFIC
RF ADAPTER
PCS-1
12V
JBV-1
TRANSCEIVER
Measurement
equipment
CA-52PS
CA-5S
PRODUCT SPECIFIC
DOCKING STATION
ADAPTER

Figure 5 RF-test/BB-tune concept with JBV-1

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EM calibration concept with JBV-1

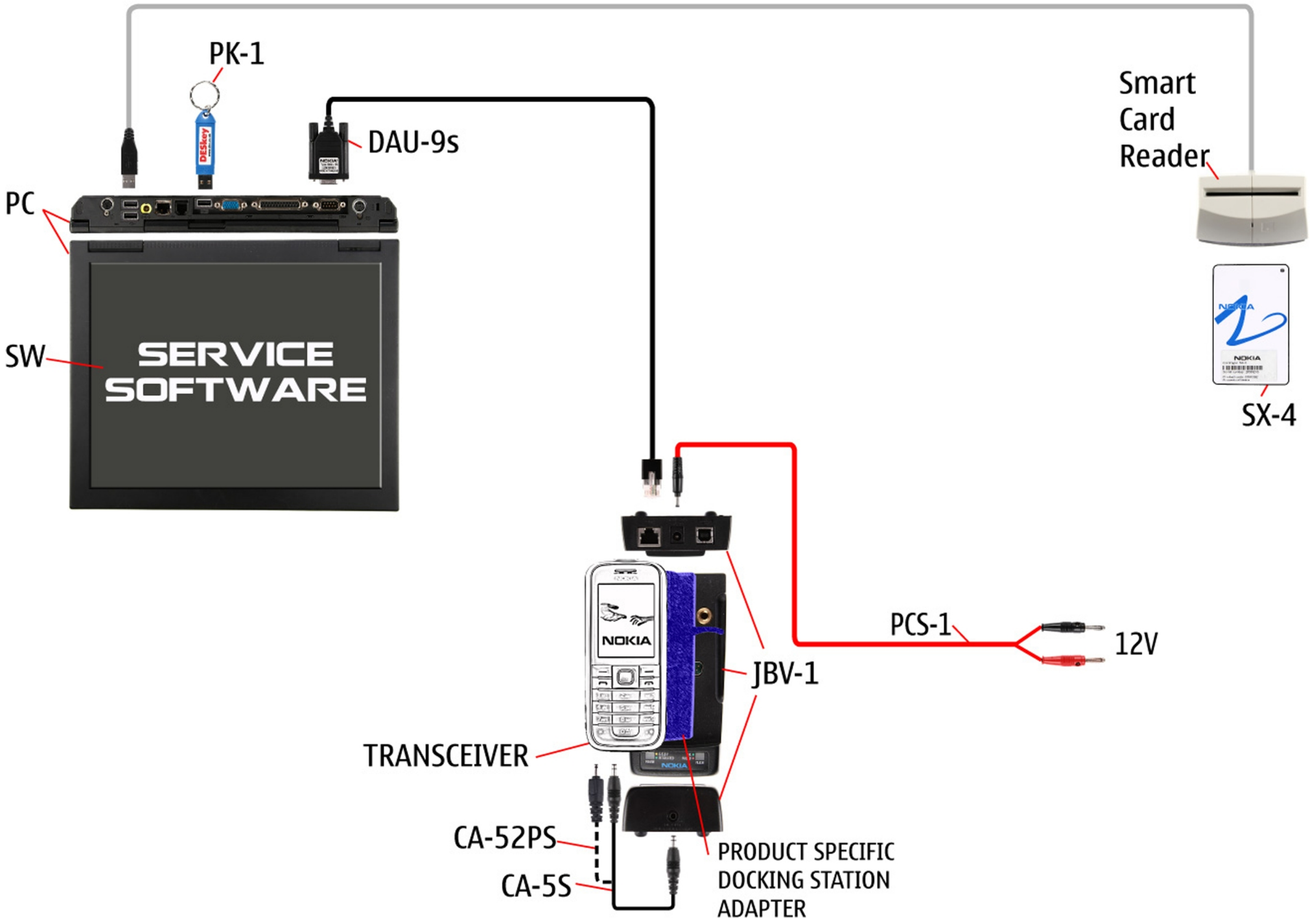
PK-1
DAU-9s
Smart
Card
Reader
PC
SW
SERVICE
SOFTWARE
SX-4
PCS-1
12V
JBV-1
TRANSCEIVER
CA-52PS
CA-5S
PRODUCT SPECIFIC
DOCKING STATION
ADAPTER

Figure 6 EM calibration concept with JBV-1

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RF-test/BB-tune & flash concept with JBV-1, FPS-10

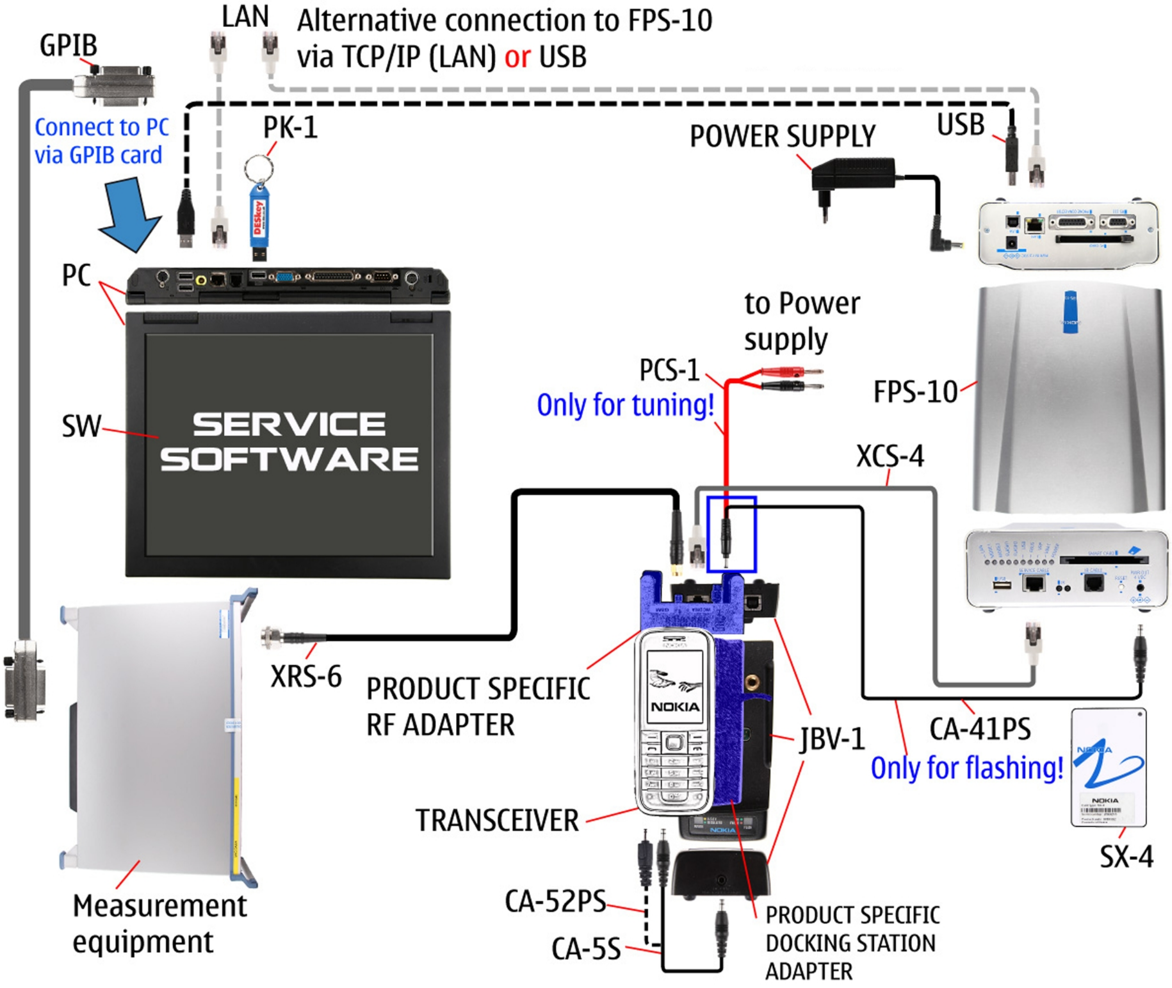
GPIB
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
Connect to PC
via GPIB card
PK-1
POWER SUPPLY
USB
PC
to Power
supply
PCS-1
Only for tuning!
FPS-10
SW
SERVICE
SOFTWARE
XCS-4
XRS-6
PRODUCT SPECIFIC
RF ADAPTER
JBV-1
CA-41PS
Only for flashing!
TRANSCEIVER
SX-4
Measurement
equipment
CA-52PS
CA-5S
PRODUCT SPECIFIC
DOCKING STATION
ADAPTER

Figure 7 RF-test/BB-tune & flash concept with JBV-1, FPS-10

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RF/BB tune& flash concept with MJ-167, FPS-10

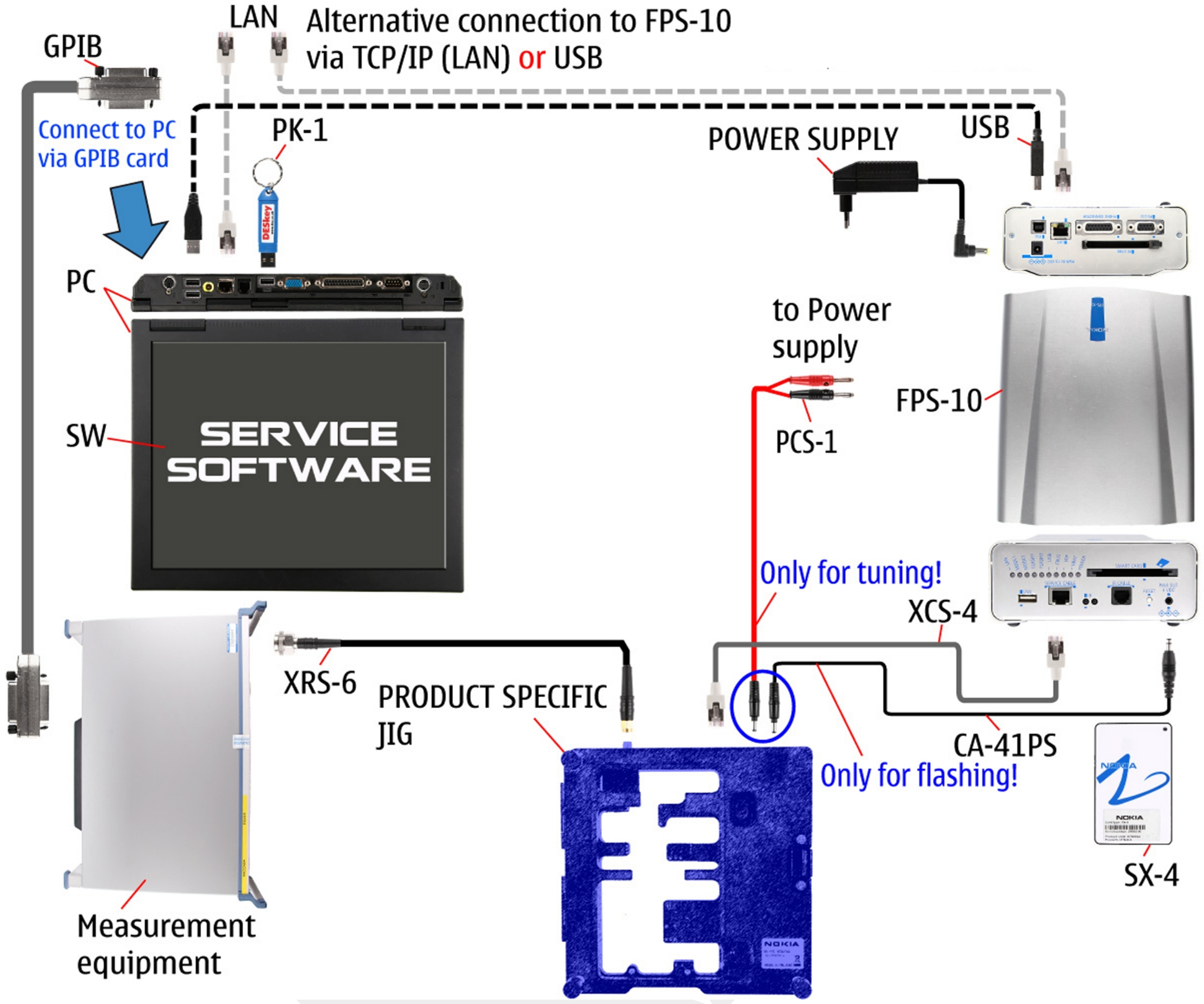
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
GPIB
Connect to PC
via GPIB card
PK-1
POWER SUPPLY
USB
PC
to Power
supply
FPS-10
PCS-1
SW
SERVICE
SOFTWARE
Only for tuning!
XCS-4
XRS-6
PRODUCT SPECIFIC
JIG
CA-41PS
Only for flashing!
SX-4
Measurement
equipment

Figure 8 RF/BB tune& flash concept with MJ-167, FPS-10

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3 — Baseband Troubleshooting Instructions

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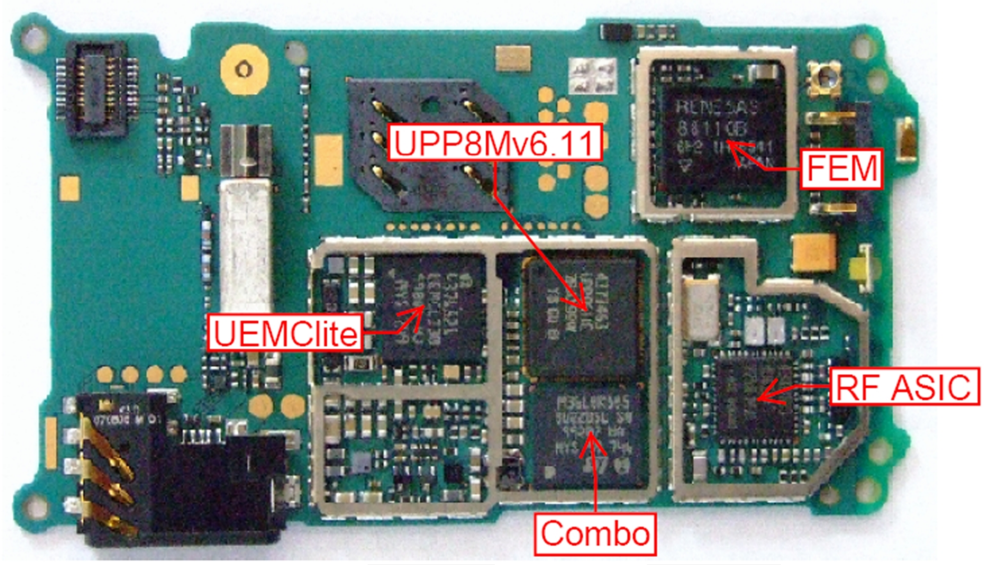
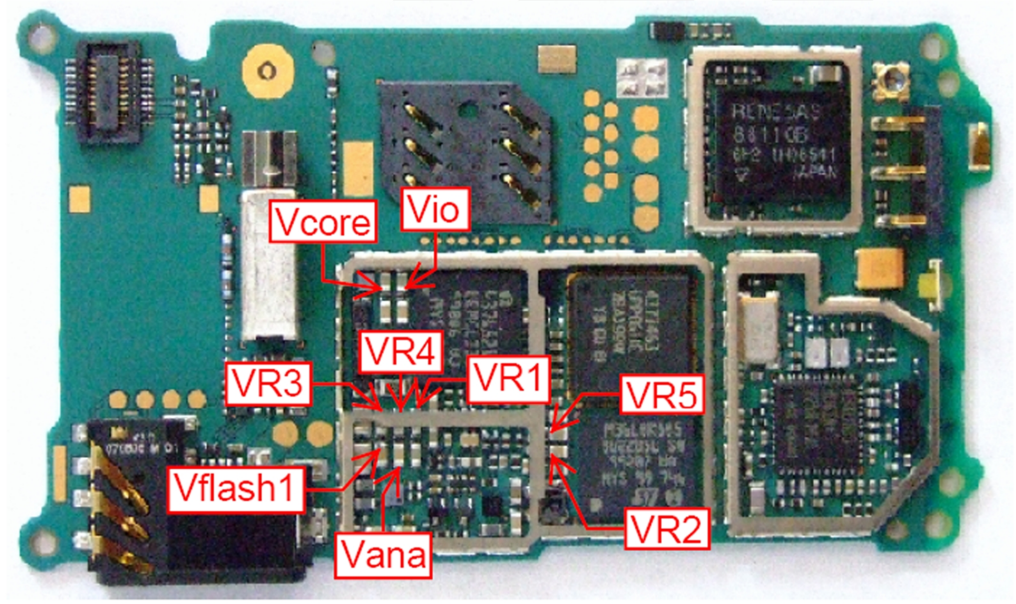
General baseband troubleshooting

Key components


UPP8Mv6.11
FEM
UEMClite
RF ASIC
Combo

Power supply test points


Vcore
Vio
VR4
VR3
VR1
VR5
Vflash1
Vana
VR2

Phone cannot be powered on (I)

Context

This means that the phone does not use any current at all when the supply is connected and/or power key is pressed. It is assumed that the voltage supplied is 3.6VDC. The UEMCLite will prevent any functionality at battery/supply levels below 2.9VDC.

Troubleshooting flow

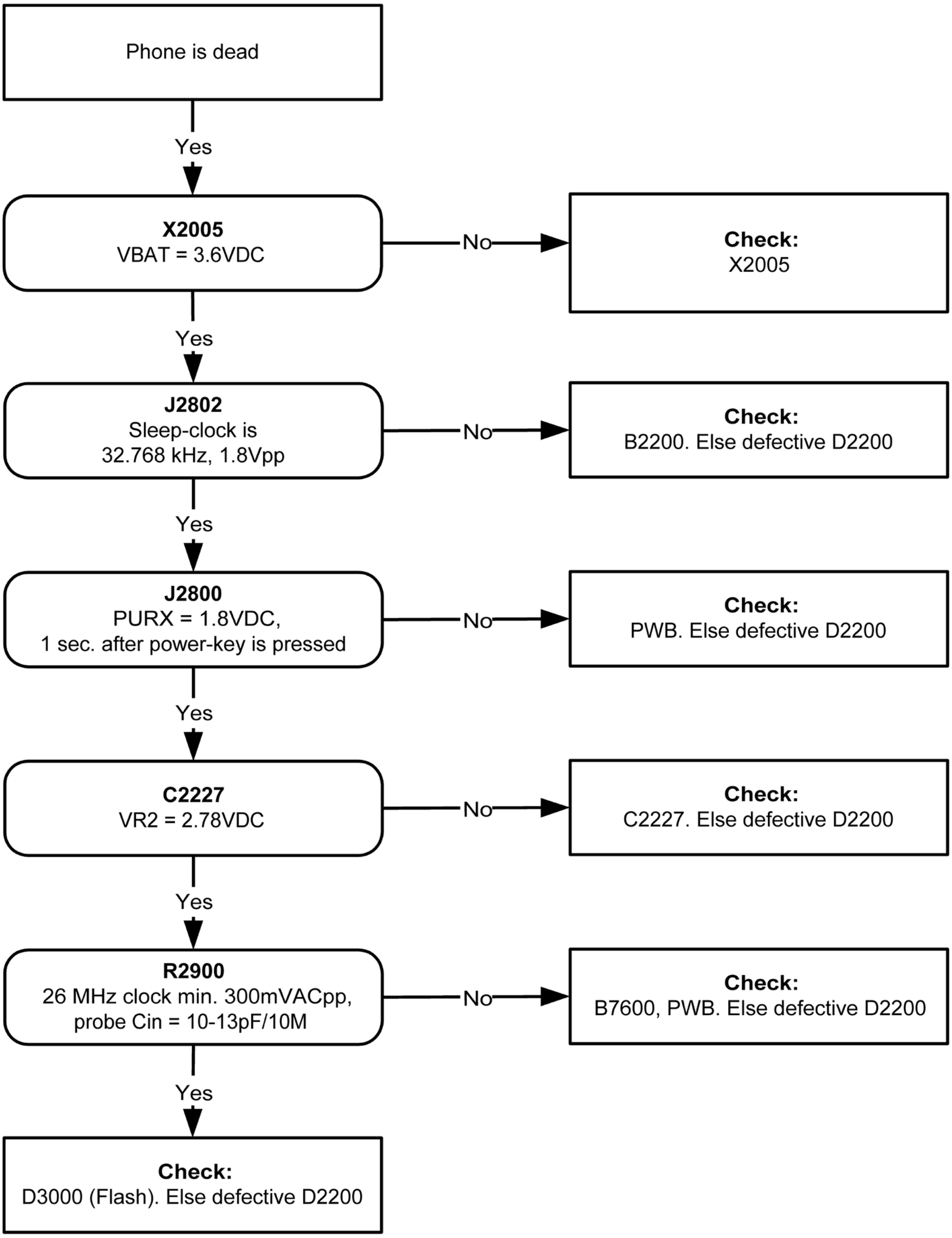

Phone is dead
Yes
X2005
VBAT = 3.6VDC
No
Check:
X2005
Yes
J2802
Sleep-clock is
32.768 kHz, 1.8Vpp
No
Check:
B2200. Else defective D2200
Yes
J2800
PURX = 1.8VDC,
1 sec. after power-key is pressed
No
Check:
PWB. Else defective D2200
Yes
C2227
VR2 = 2.78VDC
No
Check:
C2227. Else defective D2200
Yes
R2900
26 MHz clock min. 300mVACpp,
probe Cin = 10-13pF/10M
No
Check:
B7600, PWB. Else defective D2200
Yes
Check:
D3000 (Flash). Else defective D2200

Figure 9 Troubleshooting when phone cannot be powered on

Phone cannot be powered on (II)

Context

If this kind of failure is presenting itself immediately after FLALI, it is most likely caused by ASIC's missing contact with PWB.

If the MCU doesn't service the watchdog register within the UEMCLite, the operations watchdog will run out after approximately 32 seconds. Unfortunately, the service routine can not be measured.

Troubleshooting flow

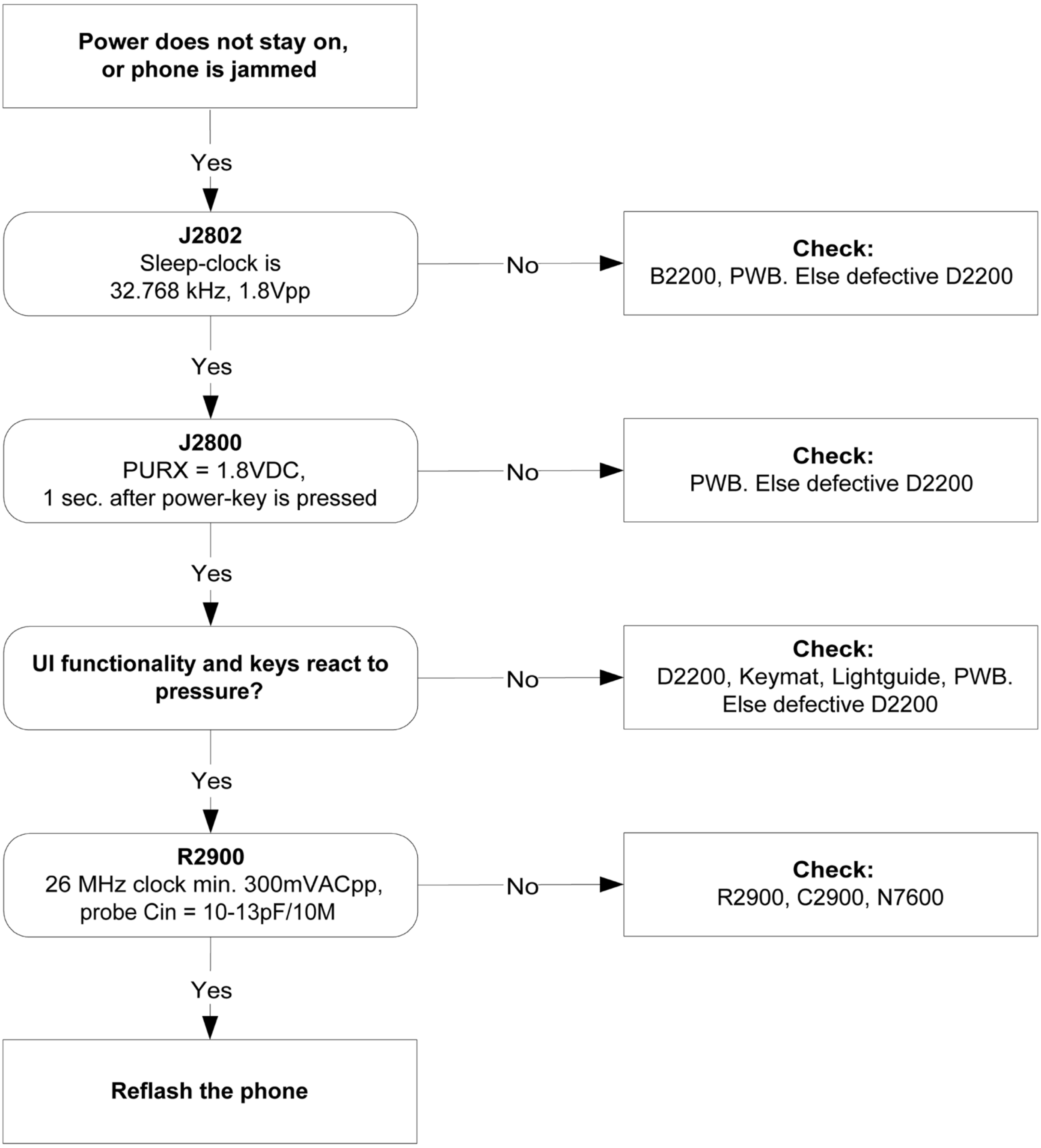

Power does not stay on, or phone is jammed
Yes
J2802 Sleep-clock is 32.768 kHz, 1.8Vpp
No
Check: B2200, PWB. Else defective D2200
Yes
J2800 PURX = 1.8VDC, 1 sec. after power-key is pressed
No
Check: PWB. Else defective D2200
Yes
UI functionality and keys react to pressure?
No
Check: D2200, Keymat, Lightguide, PWB. Else defective D2200
Yes
R2900 26 MHz clock min. 300mVACpp, probe Cin = 10-13pF/10M
No
Check: R2900, C2900, N7600
Yes
Reflash the phone

Figure 10 Troubleshooting when phone does not stay on or phone is jammed

Phone cannot be flashed

Context

The flash programming can be done via the pads on the PWB (J2060). If failed, then follow up the trouble shooting flow chart.

In case of flash failure in the FLALI station, swap the phone and send it back to the care program for further analysis. Possible failures could be short-circuit of balls under µBGAs (UEMCLite, UPP8M, FLASH), or missing or misaligned components.

In flash programming error cases, the flash prommer can give some information about a fault. The fault information messages could be:

Phone doesn't set FBUS_TX line low

Because of the use of uBGA components, it is not possible to verify if there is a short circuit in the control and address lines of MCU (UPP8M) and the memory (flash).

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Troubleshooting flow

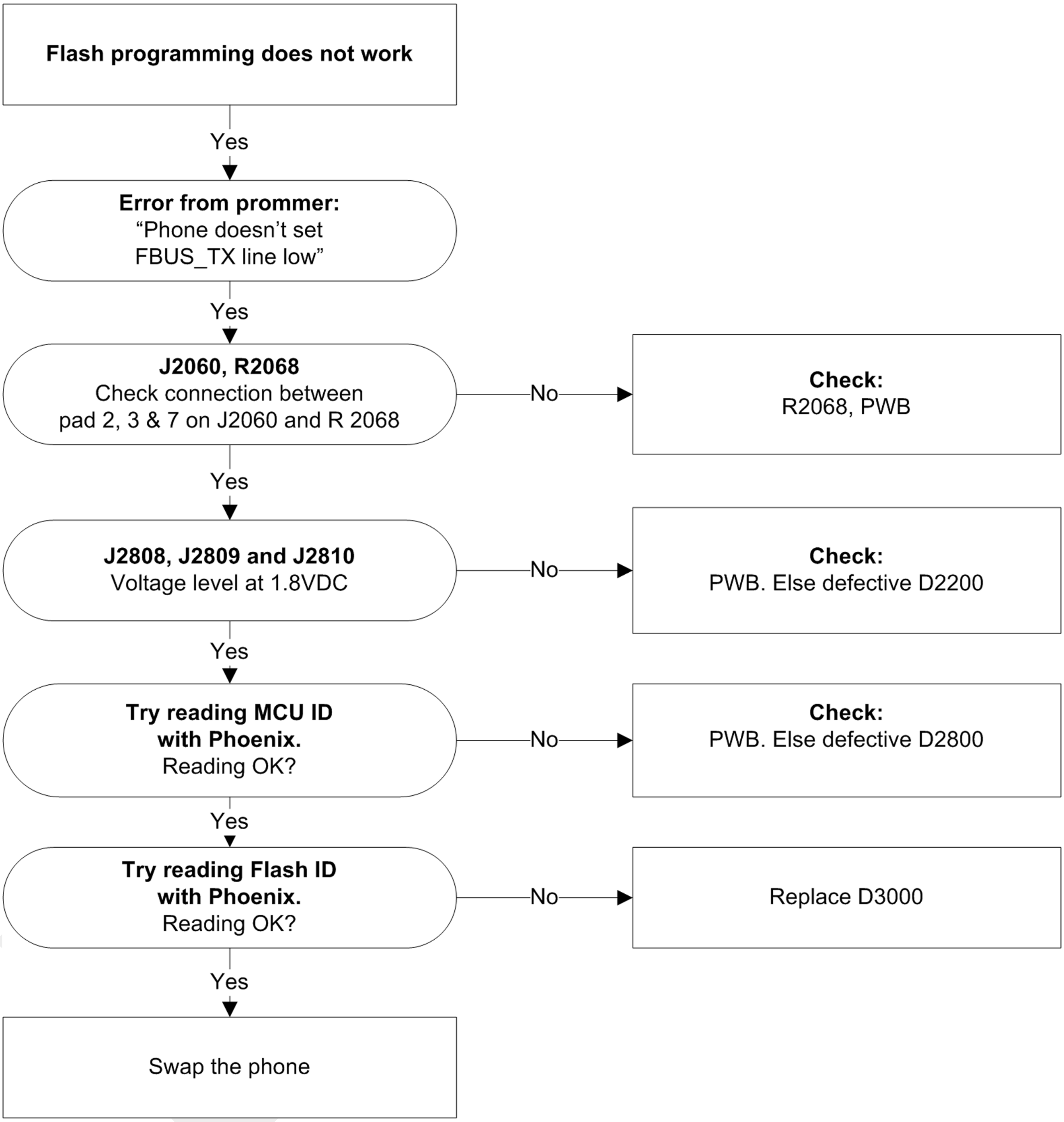
Flash programming does not work
Yes
Error from prommer:
"Phone doesn't set
FBUS_TX line low"
Yes
J2060, R2068
Check connection between
pad 2, 3 & 7 on J2060 and R 2068
No
Check:
R2068, PWB
Yes
J2808, J2809 and J2810
Voltage level at 1.8VDC
No
Check:
PWB. Else defective D2200
Yes
Try reading MCU ID
with Phoenix.
Reading OK?
No
Check:
PWB. Else defective D2800
Yes
Try reading Flash ID
with Phoenix.
Reading OK?
No
Replace D3000
Yes
Swap the phone

Figure 11 Flash programming fault

Easy flash programming does not work

Context

The flash programming can be done via the easy flash connector.If failed, then follow up the trouble shooting below.

It is not possible to verify if there is a short circuit in control- and address lines of MCU (UPP8M) and memory (flash) because BGA package is used in RH-116/117.

Troubleshooting flow

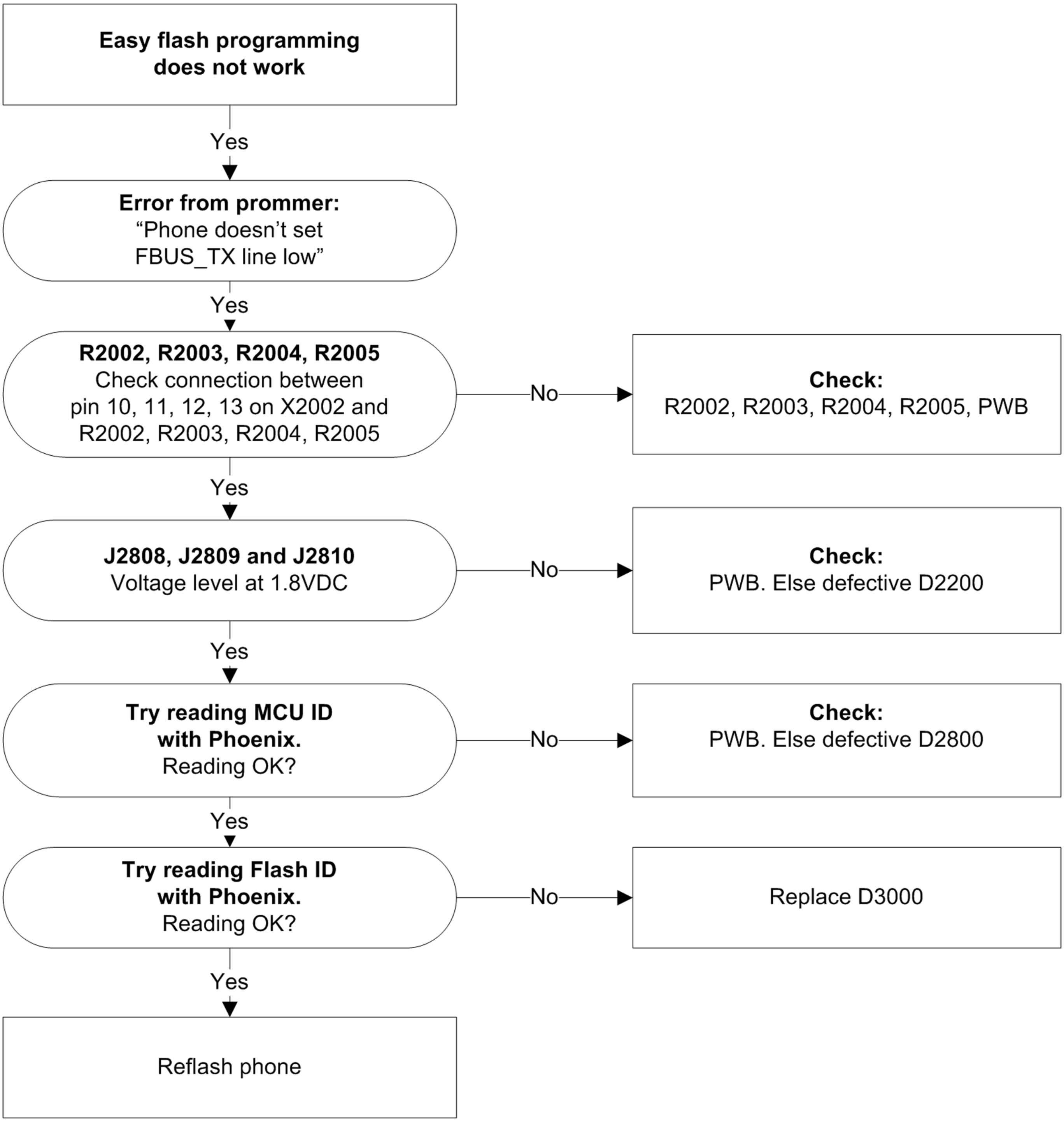
Easy flash programming does not work
Yes
Error from prommer: "Phone doesn't set FBUS_TX line low"
Yes
R2002, R2003, R2004, R2005 Check connection between pin 10, 11, 12, 13 on X2002 and R2002, R2003, R2004, R2005
No
Check: R2002, R2003, R2004, R2005, PWB
Yes
J2808, J2809 and J2810 Voltage level at 1.8VDC
No
Check: PWB. Else defective D2200
Yes
Try reading MCU ID with Phoenix. Reading OK?
No
Check: PWB. Else defective D2800
Yes
Try reading Flash ID with Phoenix. Reading OK?
No
Replace D3000
Yes
Reflash phone

Figure 12 Easy flash programming fault

Display shows "Contact Service"

Troubleshooting flow

This error can only happen at power up where several self-tests are run. If any of these test cases fails the display will show the message: "Contact Service".

They are individual test cases, so the below lineup of error hunting's has no chronological order. Use common sense and experience to decide which test case to start error hunting at.

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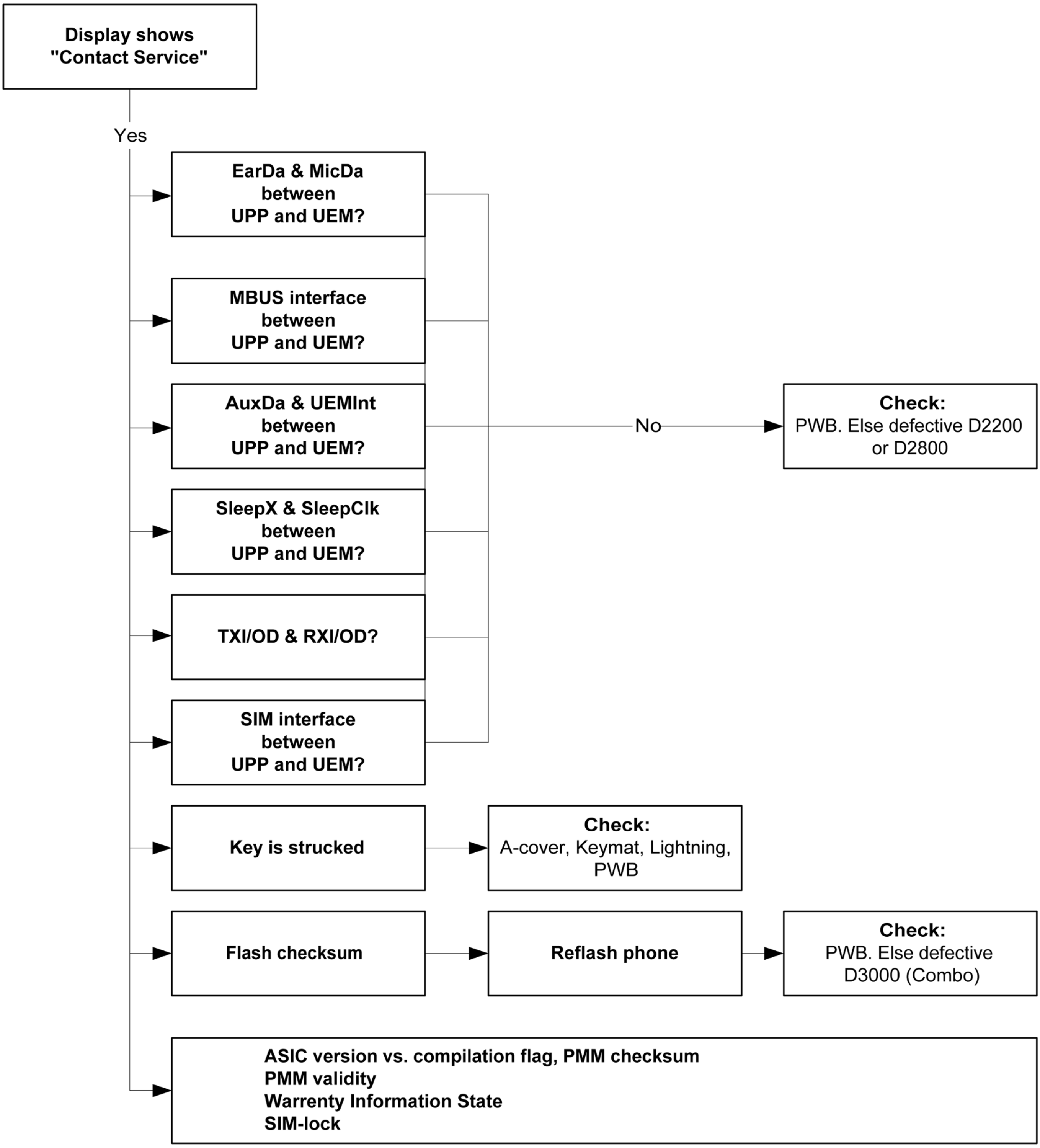
Display shows "Contact Service"
Yes
EarDa & MicDa between UPP and UEM?
MBUS interface between UPP and UEM?
AuxDa & UEMInt between UPP and UEM?
SleepX & SleepClk between UPP and UEM?
TXI/OD & RXI/OD?
SIM interface between UPP and UEM?
No
Check: PWB. Else defective D2200 or D2800
Key is strucked
Check: A-cover, Keymat, Lightning, PWB
Flash checksum
Reflash phone
Check: PWB. Else defective D3000 (Combo)
ASIC version vs. compilation flag, PMM checksum
PMM validity
Warrenty Information State
SIM-lock

Figure 13 Troubleshooting when the "Contact Service" message is seen

The phone does not register to the networks, or the phone cannot make a call

Context

If the phone doesn't register to the network, the fault can be in either BB or RF. Only few signals can be tested since several signals are 'buried' in one or more of the inner layers of the PWB.

First, check that SIM LOCK is not causing the error by using a Test-SIM card and connect the phone to a tester.

Troubleshooting flow

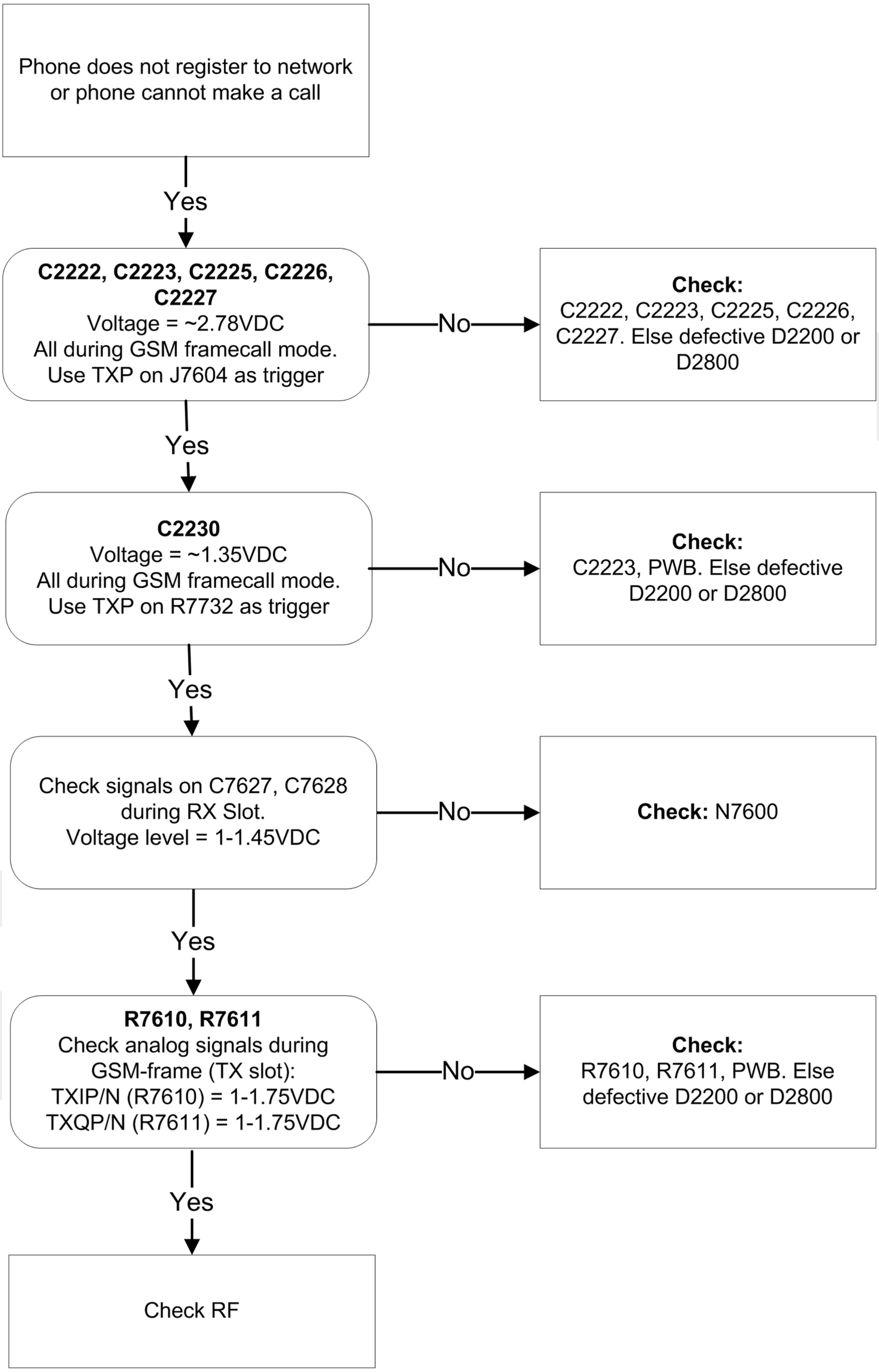
Phone does not register to network or phone cannot make a call
Yes
C2222, C2223, C2225, C2226, C2227
Voltage = ~2.78VDC
All during GSM framecall mode.
Use TXP on J7604 as trigger
No
Check:
C2222, C2223, C2225, C2226, C2227. Else defective D2200 or D2800
Yes
C2230
Voltage = ~1.35VDC
All during GSM framecall mode.
Use TXP on R7732 as trigger
No
Check:
C2223, PWB. Else defective D2200 or D2800
Yes
Check signals on C7627, C7628 during RX Slot.
Voltage level = 1-1.45VDC
No
Check: N7600
Yes
R7610, R7611
Check analog signals during GSM-frame (TX slot):
TXIP/N (R7610) = 1-1.75VDC
TXQP/N (R7611) = 1-1.75VDC
No
Check:
R7610, R7611, PWB. Else defective D2200 or D2800
Yes
Check RF

Figure 14 No registering or call

SIM related faults

Insert SIM card fault

Troubleshooting flow

The hardware of the SIM interface from UEMCLite (D2200) to the SIM connector (X2700) can be tested without a SIM card. When the power is switched on the phone first check for a 1.8V SIM card and then a 3V SIM card. The phone will try this four times, where after it will display "Insert SIM card".

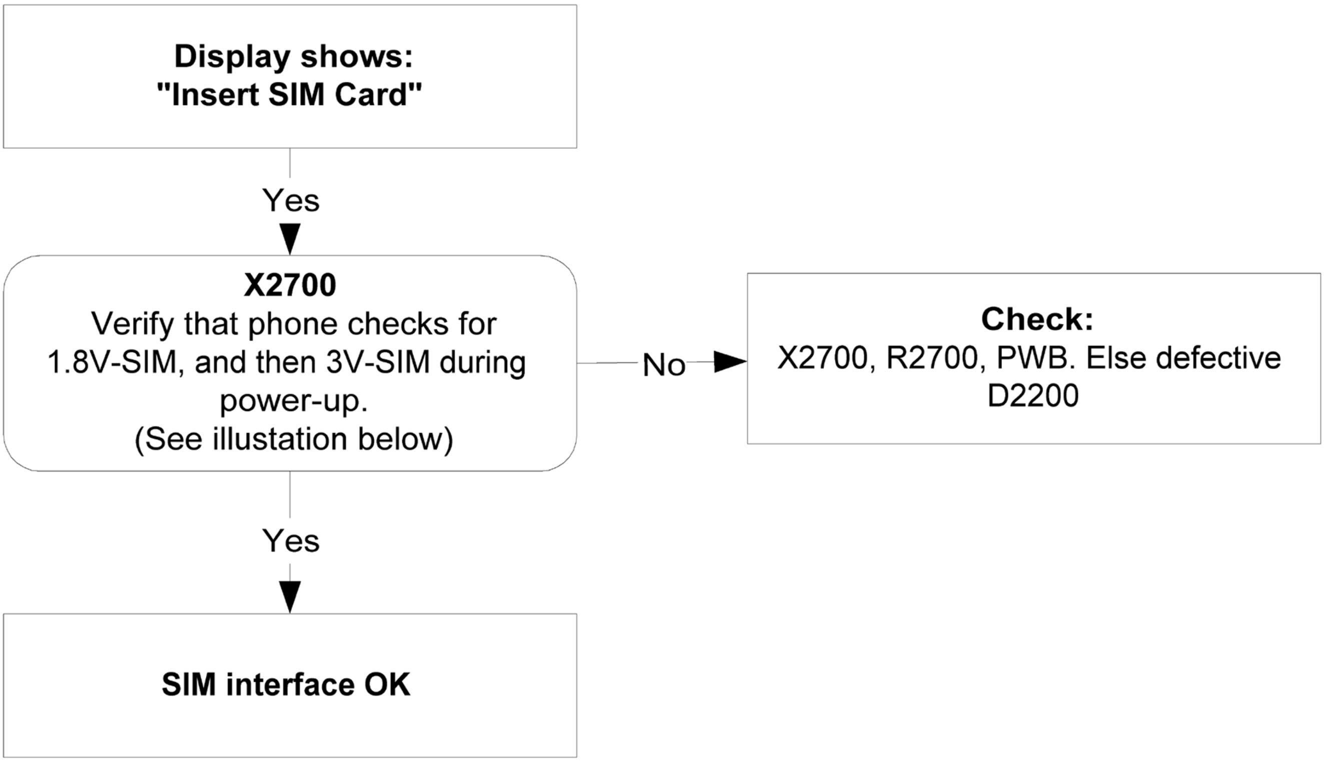
Display shows:
"Insert SIM Card"
Yes
X2700
Verify that phone checks for 1.8V-SIM, and then 3V-SIM during power-up.
(See illustation below)
No
Check:
X2700, R2700, PWB. Else defective D2200
Yes
SIM interface OK

Figure 15 Insert SIM card fault

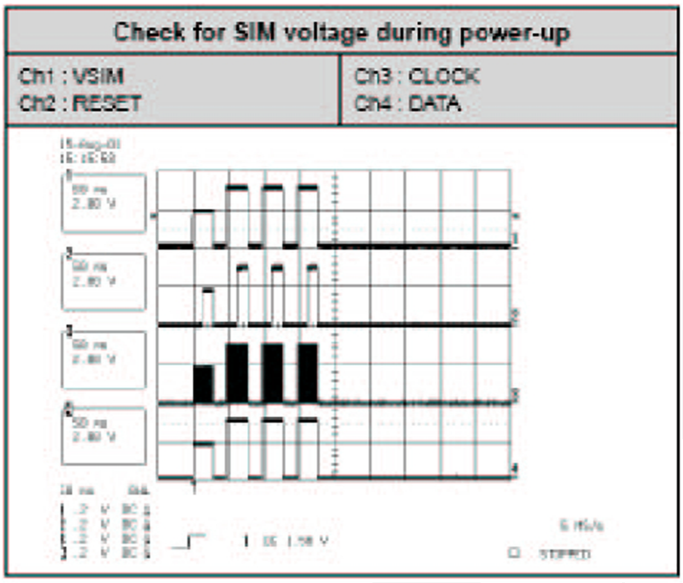

Figure 16 Signal diagram

SIM card rejected

The error ”SIM card rejected” means that the ATR message received from SIM card is corrupted, e.g. data signal levels are wrong. The first data is always ATR and it is sent from card to phone.

For reference a picture with normal SIM power-up is shown below.

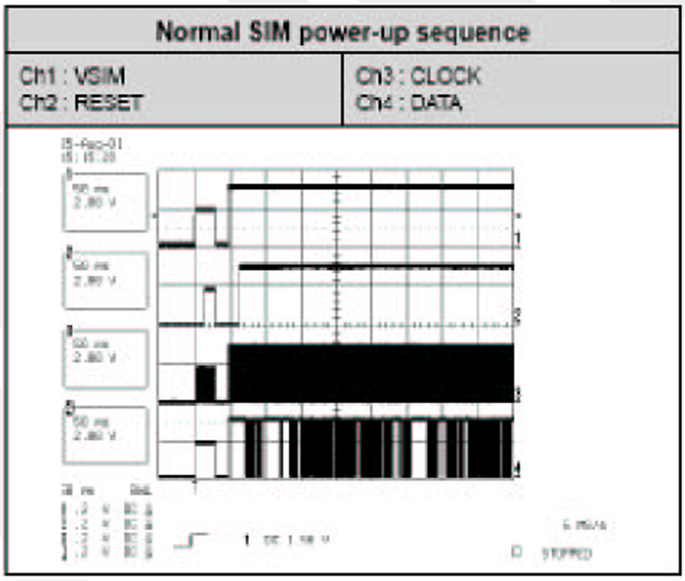

Figure 17 Signal diagram

User interface

Blank display

Context

The display does not show any information at all.

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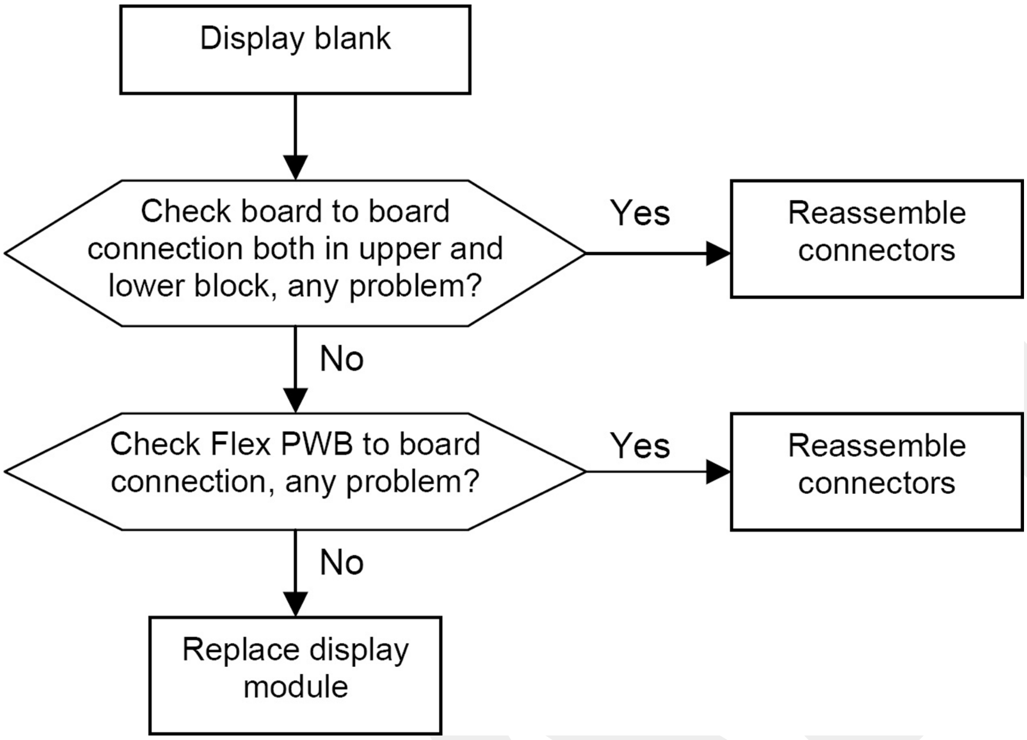
Troubleshooting flow

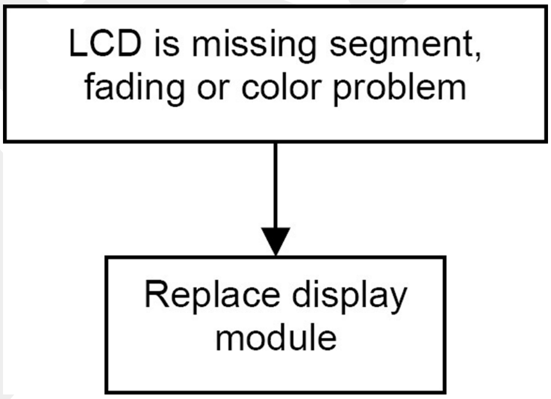

Display blank
Check board to board connection both in upper and lower block, any problem?
Yes
Reassemble connectors
No
Check Flex PWB to board connection, any problem?
Yes
Reassemble connectors
No
Replace display module

Corrupted display

Context

The display contains missing or fading segments, or color presentation is incorrect.

Troubleshooting flow


LCD is missing segment, fading or color problem
Replace display module

Dead keys

Context

One or more keys has no function.

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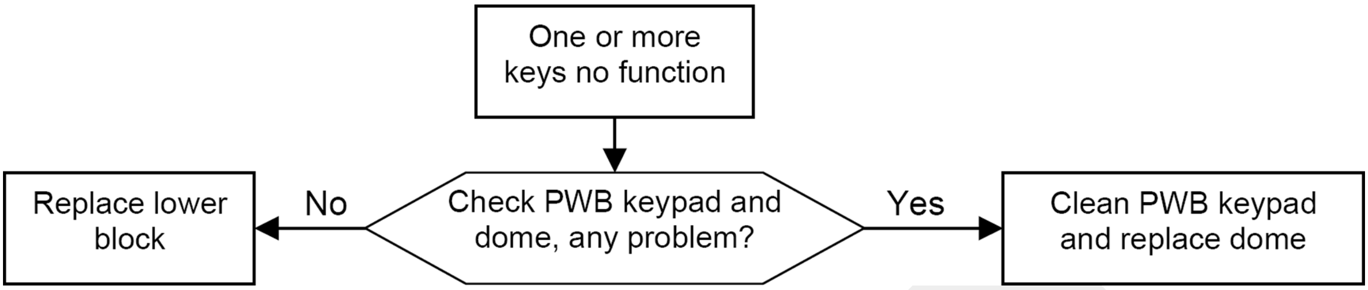
Troubleshooting flow

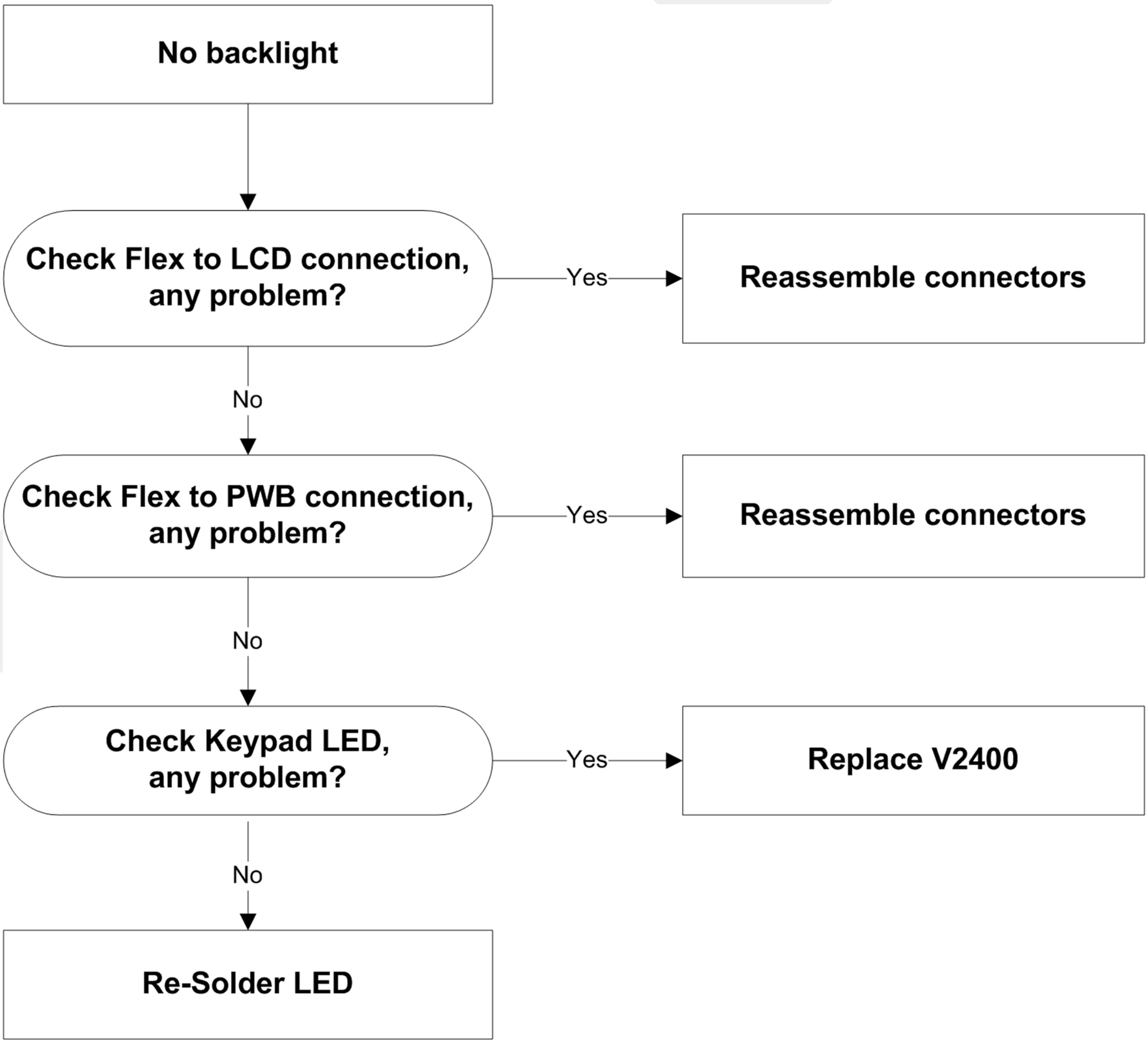

One or more keys no function
Check PWB keypad and dome, any problem?
No
Replace lower block
Yes
Clean PWB keypad and replace dome

No backlight for display or/and keys

Context

There is no backlight on the display and the keys.

Troubleshooting flow

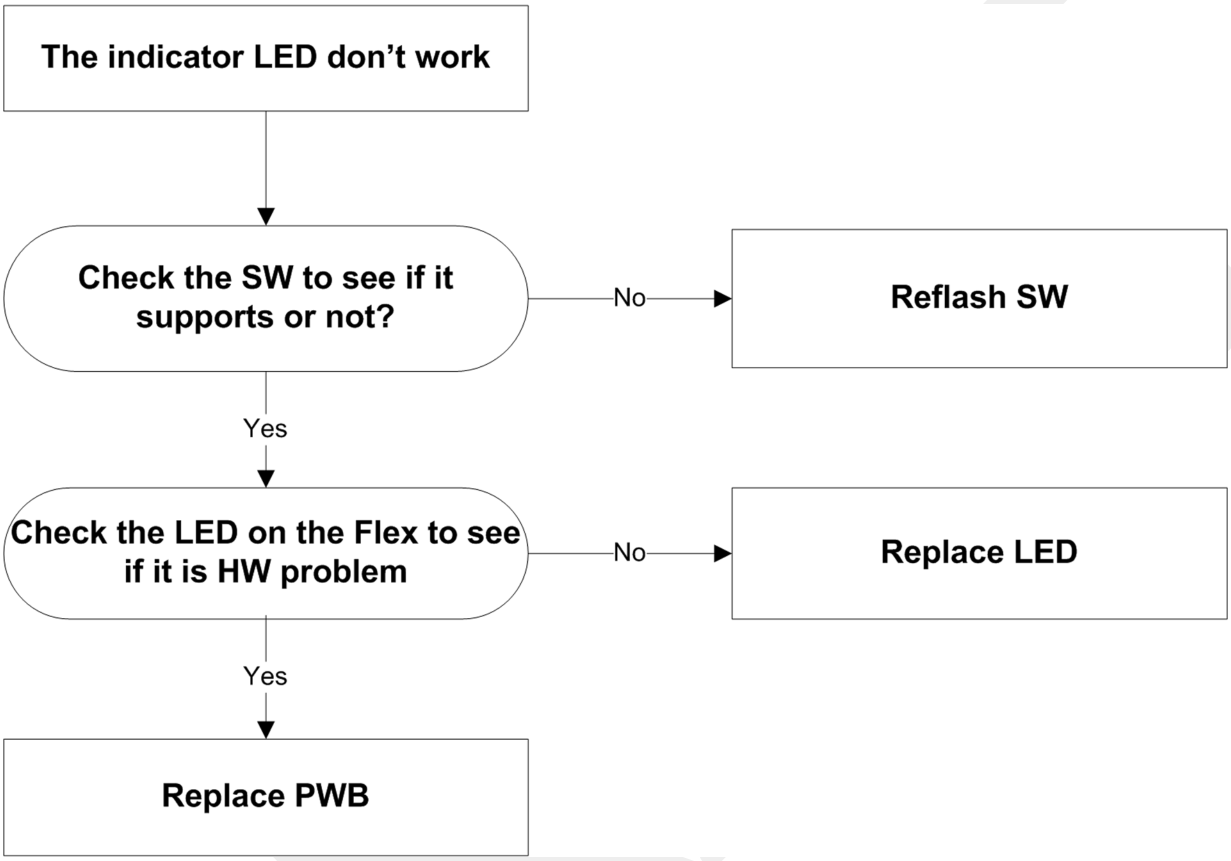

No backlight
Check Flex to LCD connection, any problem?
Yes
Reassemble connectors
No
Check Flex to PWB connection, any problem?
Yes
Reassemble connectors
No
Check Keypad LED, any problem?
Yes
Replace V2400
No
Re-Solder LED

No indicator

Context

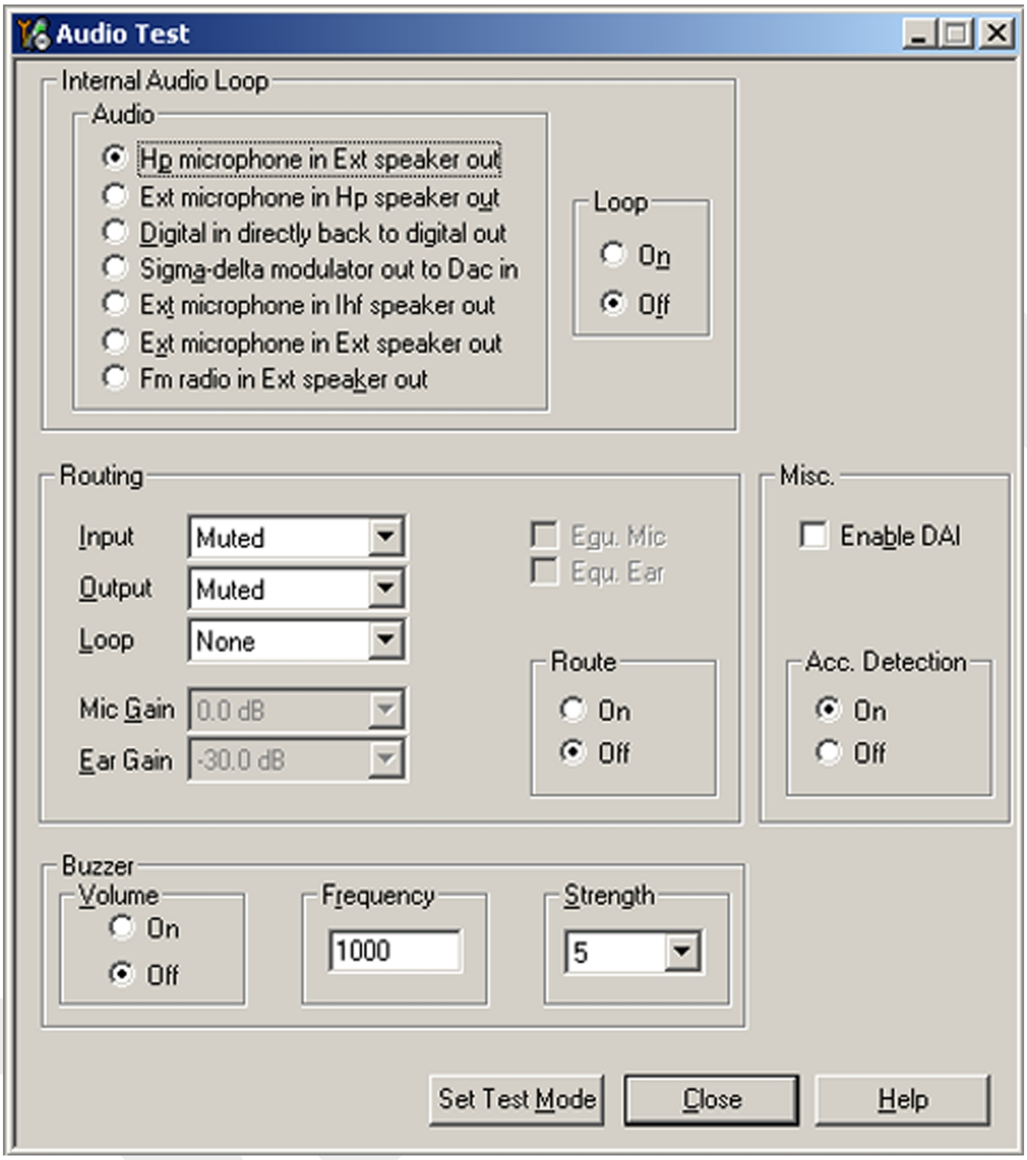
The indicator LED doesn’t work.

Troubleshooting flow


The indicator LED don’t work
Check the SW to see if it supports or not?
No
Reflash SW
Yes
Check the LED on the Flex to see if it is HW problem
No
Replace LED
Yes
Replace PWB

Audio troubleshooting

Audio troubleshooting using phoenix



Internal Audio Loop

Audio
- ● Hp microphone in Ext speaker out
- ○ Ext microphone in Hp speaker out
- ○ Digital in directly back to digital out
- ○ Sigma-delta modulator out to Dac in
- ○ Ext microphone in Ihf speaker out
- ○ Ext microphone in Ext speaker out
- ○ Fm radio in Ext speaker out

Loop
- ○ On
- ● Off

Routing

Input: Muted
Output: Muted
Loop: None
Mic Gain: 0.0 dB
Ear Gain: -30.0 dB

- ☐ Equ. Mic
- ☐ Equ. Ear

Route
- ○ On
- ● Off

Misc.
- ☐ Enable DAI

Acc. Detection
- ● On
- ○ Off

Buzzer

Volume
- ○ On
- ● Off

Frequency: 1000

Strength: 5

Figure 18 Phoenix audio test window

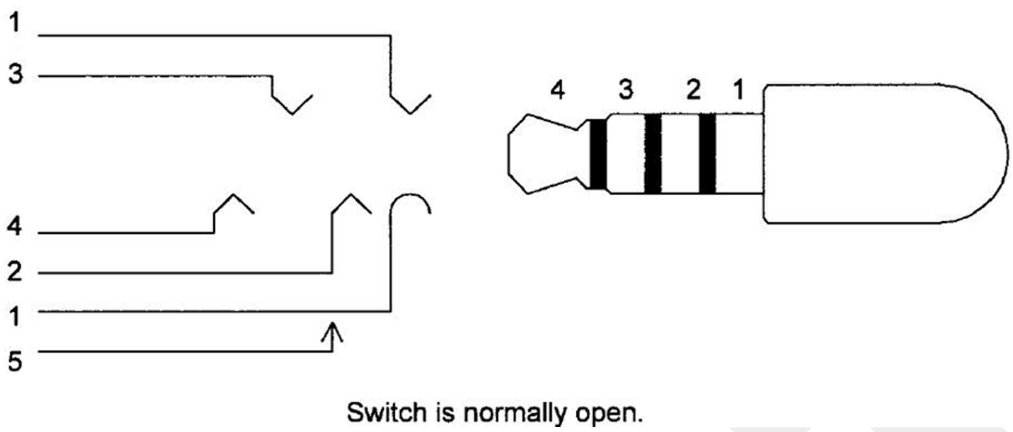


Figure 19 4-pole jack plug for audio accessory

Table 6 Connector for External Audio Accessories

Pin	Signal name	Direction	Description
5	PLUGDET	Input	Terminal internal connection, plug detection
4	HS EAR L	Output	Audio output
3	HS EAR R	Output	Audio output
2	HS MIC	Input	Multiplexed microphone audio and control data
1	HS GND	-	Ground contact

Check microphone using "Hp microphone in Ext speaker out" loop

Steps

1. Connect phone with Phoenix.
2. Open “audio test” window from “Testing -> Audio test”, as shown in *Figure Phoenix audio test window* above.
3. Select “Hp microphone in Ext speaker out”
4. Select "Acc. Detection" as "Off".
5. Select “Loop” as “On”
6. Input sound at microphone port, for example 94dB SPL 1kHz.

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7. Check if signal is detected at HS EAR L/R, shown in *Figure 4-pole jack plug for audio accessory* above.

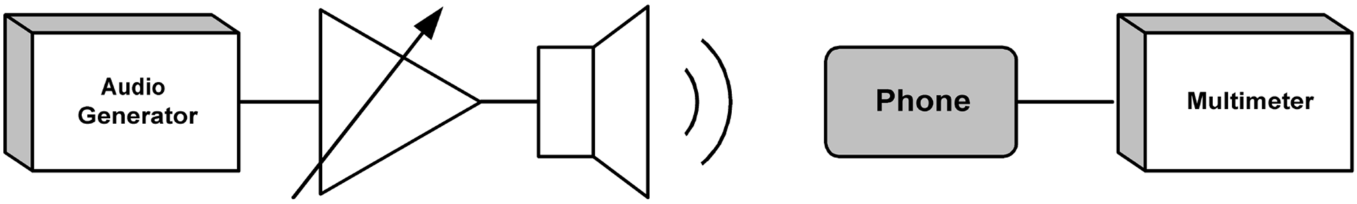

Figure 20 Test arrangement for microphone

Check earpiece using "Ext microphone in Hp speaker out" loop

Steps

1. Connect phone with Phoenix.
2. Open the *Audio Test* window from **Testing**→ **Audio test** , as shown in Figure *Phoenix audio test window* above.
3. Select **Ext microphone in Hp speaker out**.
4. Select **Acc.Detection** as **Off**.
5. Select **Loop** as **On**.
6. Input signal to HS MIC, as shown in Figure *4-pole jack plug for audio accessory* above, for example 100mVpp, 1kHz.
7. Check if sound is heard in the earpiece.

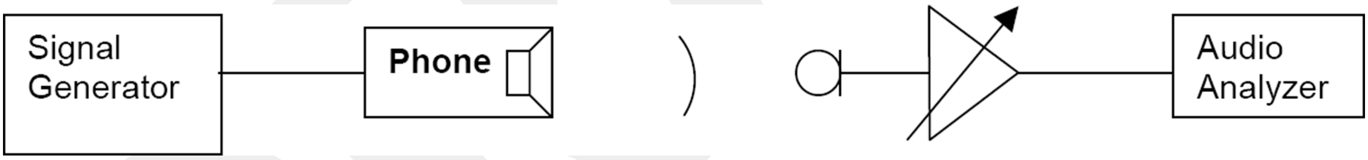

Figure 21 Test arrangement for of earpiece

Check IHF & ringing tone function using "Buzzer"

Steps

1. Connect phone with Phoenix.
2. Open “audio test” window from “Testing -> Audio test”, as shown in *Figure Phoenix audio test window* above.
3. In “Buzzer” area, select suitable signal to be played, for example 1 kHz, Strength 5”
4. Select “Volume” as “On”

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5. Check if sound is heard in IHF.

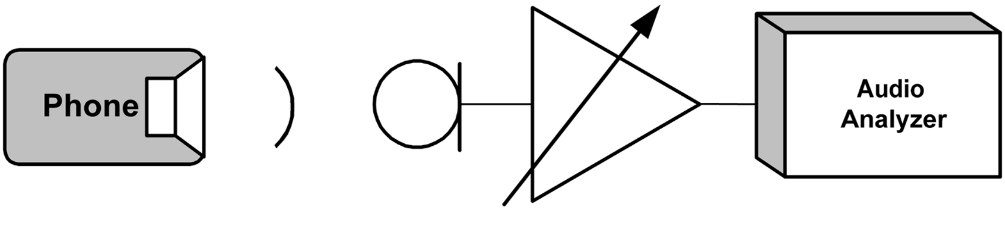
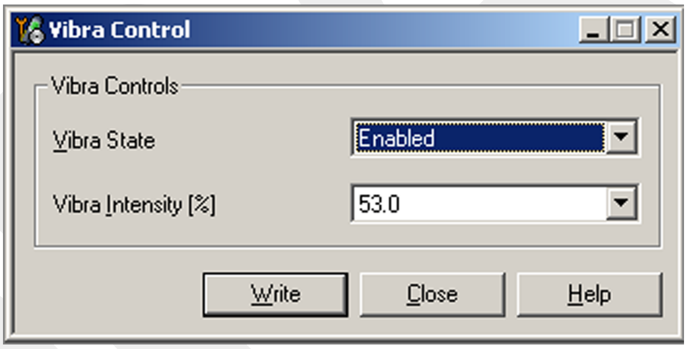

Phone
Audio
Analyzer

Figure 22 Checking IHF and ring tone by using "Buzzer"

Check vibra function using "Vibra control"

Steps

1. Connect phone with Phoenix.
2. Open “Vibra control” window from “Testing -> Vibra control”, as shown in the figure below.
3. Select suitable intensity value, for example 53 %.
4. Select “Vibra state” as “Enabled”
5. Click “Write”.
6. Check if Vibra works.


Vibra Control
Vibra Controls

Vibra State: Enabled

Vibra Intensity [%]: 53.0

Write
Close
Help

Figure 23 Checking vibra function by using vibra control

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Earpiece fault

Troubleshooting flow

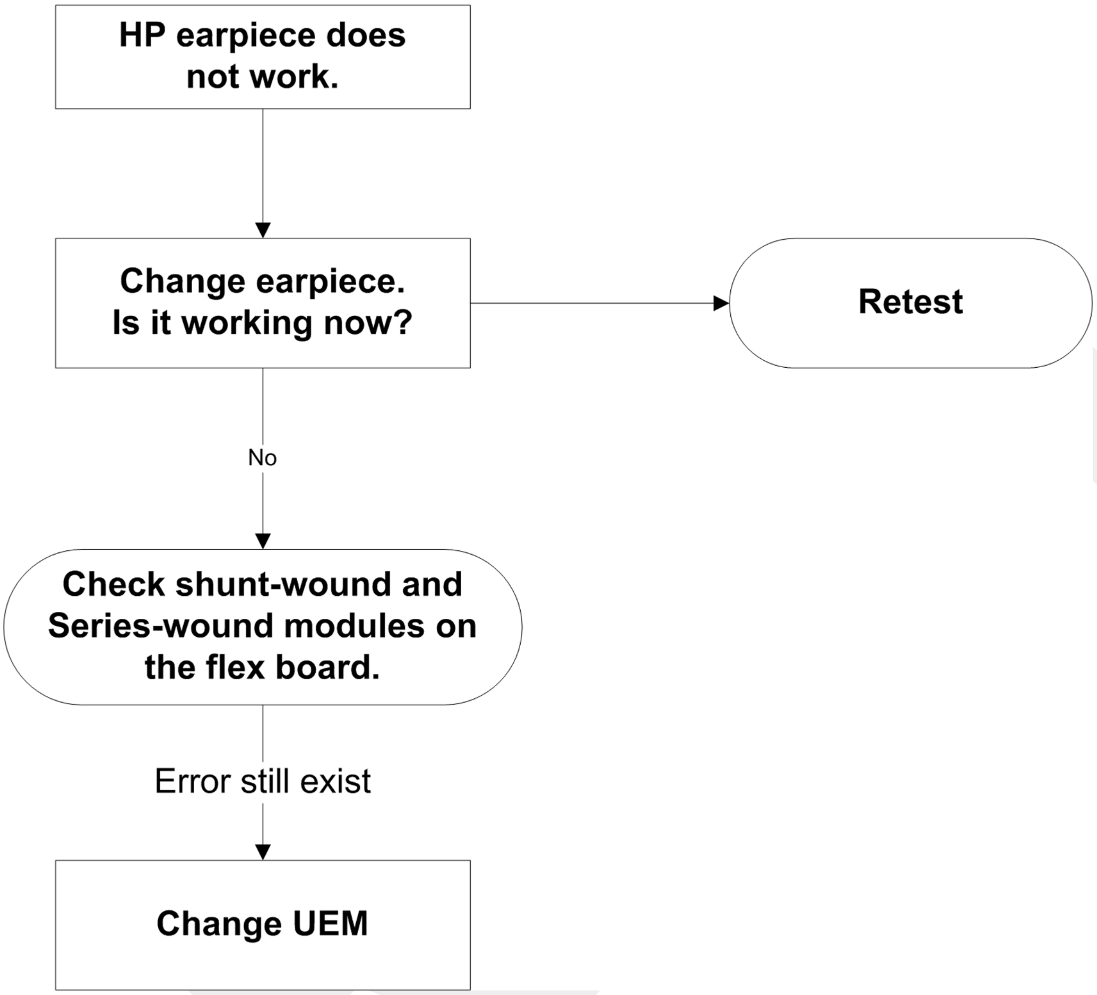
HP earpiece does not work.
Change earpiece. Is it working now?
Retest
No
Check shunt-wound and Series-wound modules on the flex board.
Error still exist
Change UEM

Figure 24 Earpiece fault flow chart

IHF/ringing tone fault

Troubleshooting flow

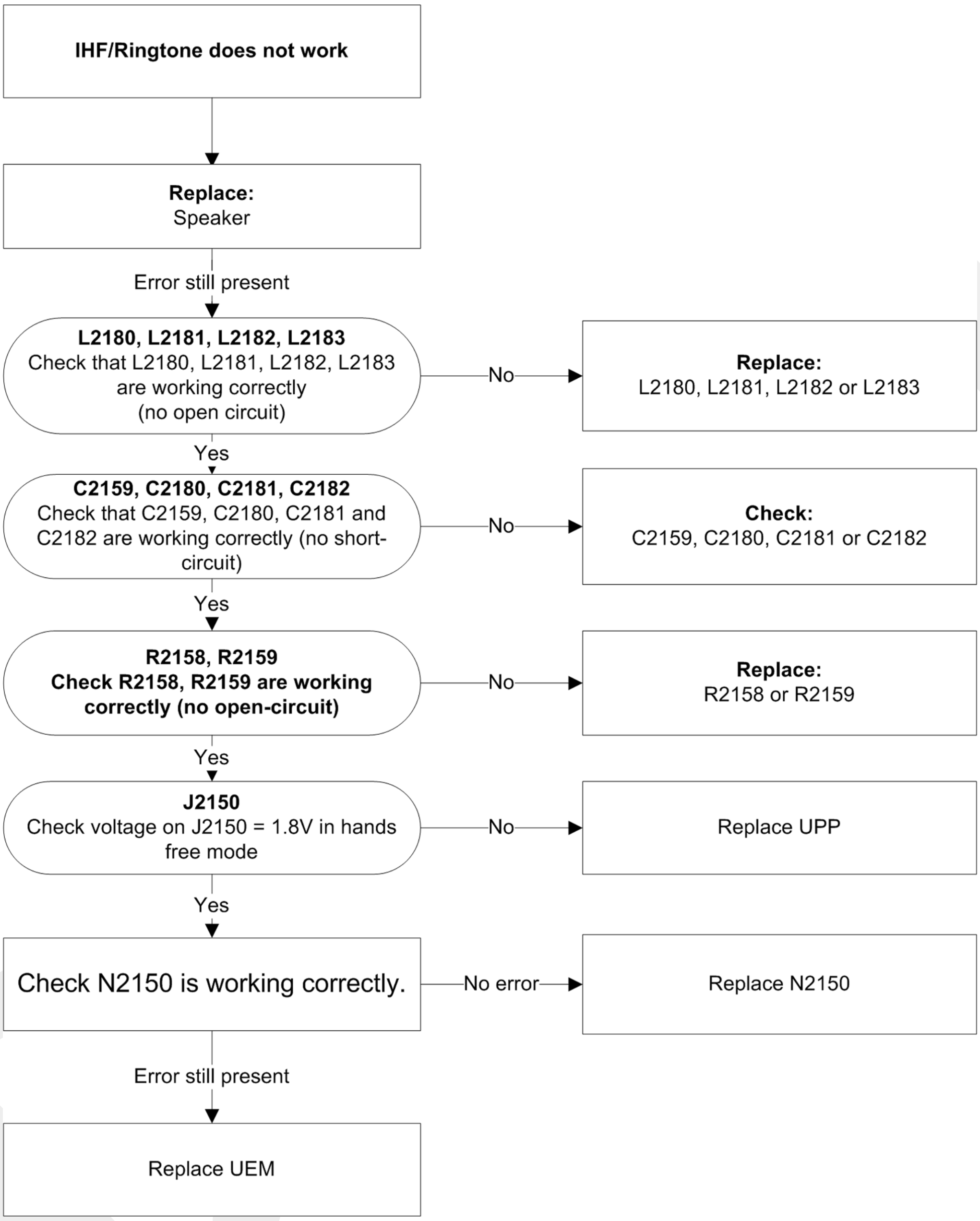
IHF/Ringtone does not work
Replace:
Speaker
Error still present
L2180, L2181, L2182, L2183
Check that L2180, L2181, L2182, L2183 are working correctly (no open circuit)
No
Replace:
L2180, L2181, L2182 or L2183
Yes
C2159, C2180, C2181, C2182
Check that C2159, C2180, C2181 and C2182 are working correctly (no short-circuit)
No
Check:
C2159, C2180, C2181 or C2182
Yes
R2158, R2159
Check R2158, R2159 are working correctly (no open-circuit)
No
Replace:
R2158 or R2159
Yes
J2150
Check voltage on J2150 = 1.8V in hands free mode
No
Replace UPP
Yes
Check N2150 is working correctly.
No error
Replace N2150
Error still present
Replace UEM

Figure 25 IHF/ringing tone fault flow chart

Microphone fault

Troubleshooting flow

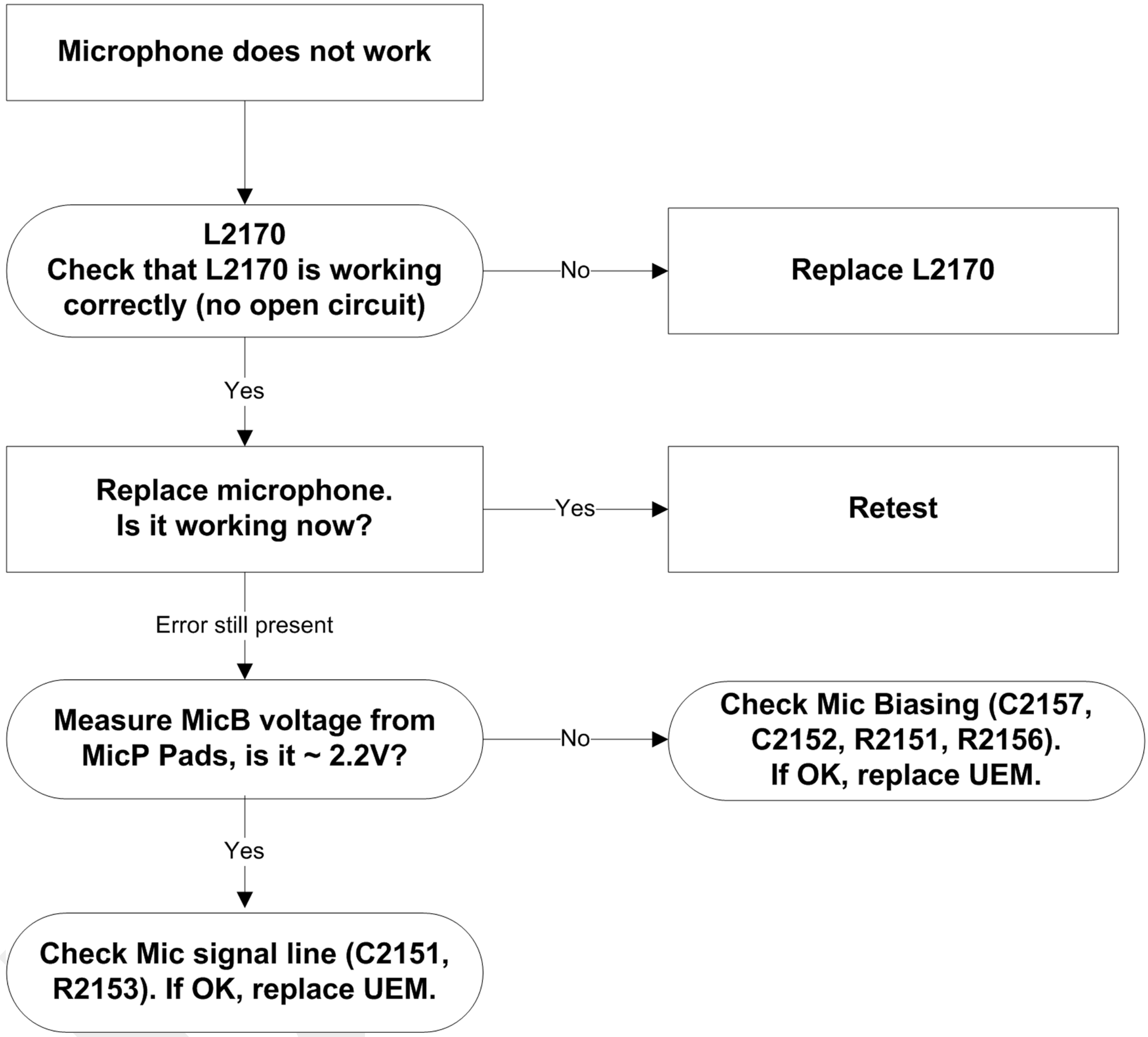
Microphone does not work
L2170
Check that L2170 is working correctly (no open circuit)
No
Replace L2170
Yes
Replace microphone. Is it working now?
Yes
Retest
Error still present
Measure MicB voltage from MicP Pads, is it ~ 2.2V?
No
Check Mic Biasing (C2157, C2152, R2151, R2156). If OK, replace UEM.
Yes
Check Mic signal line (C2151, R2153). If OK, replace UEM.

Figure 26 Microphone fault flow chart

Headset earpiece fault

Troubleshooting flow

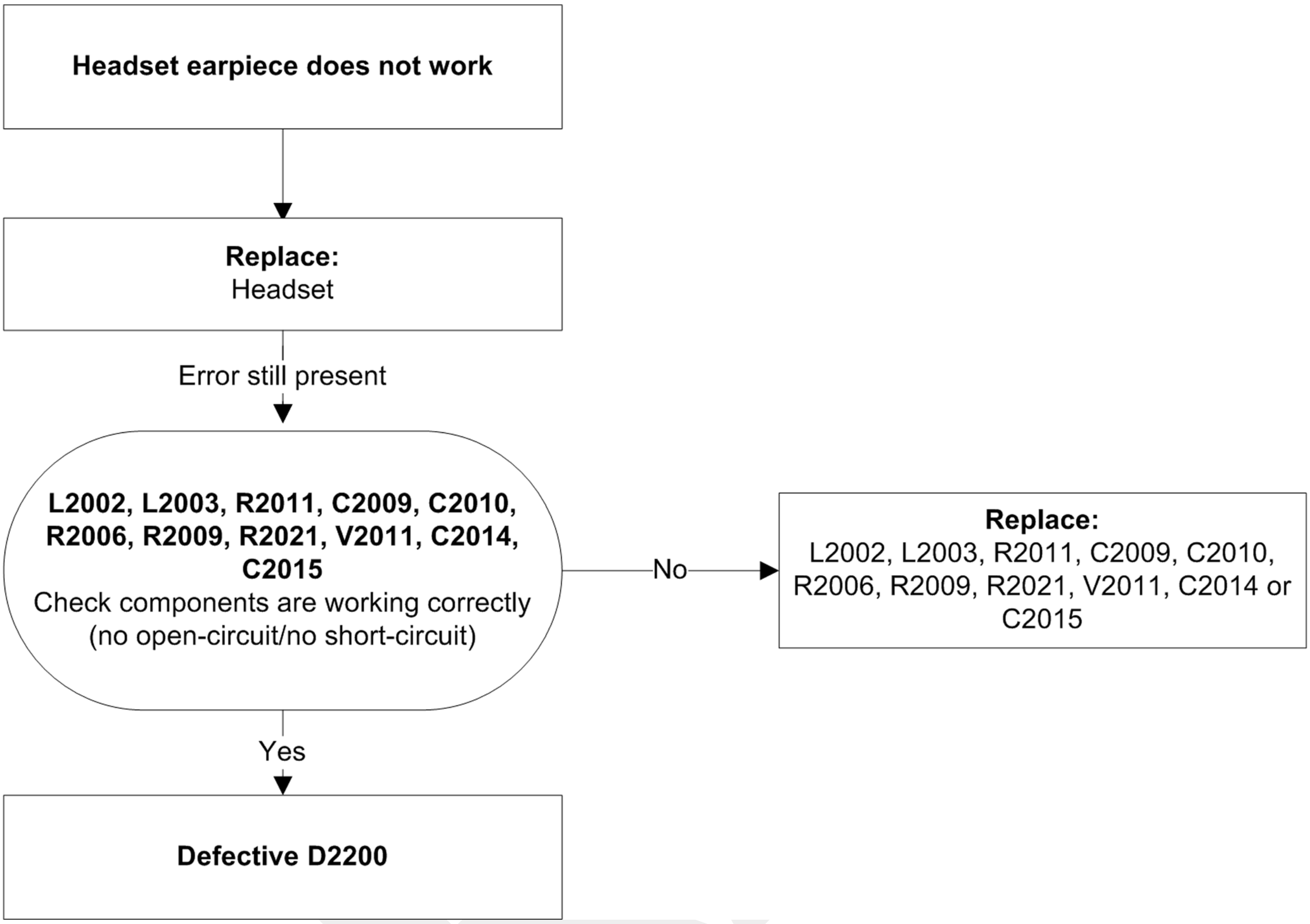
Headset earpiece does not work
Replace:
Headset
Error still present
L2002, L2003, R2011, C2009, C2010, R2006, R2009, R2021, V2011, C2014, C2015
Check components are working correctly (no open-circuit/no short-circuit)
No
Replace:
L2002, L2003, R2011, C2009, C2010, R2006, R2009, R2021, V2011, C2014 or C2015
Yes
Defective D2200

Figure 27 Headset earpiece fault flow chart

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Headset microphone fault

Troubleshooting flow

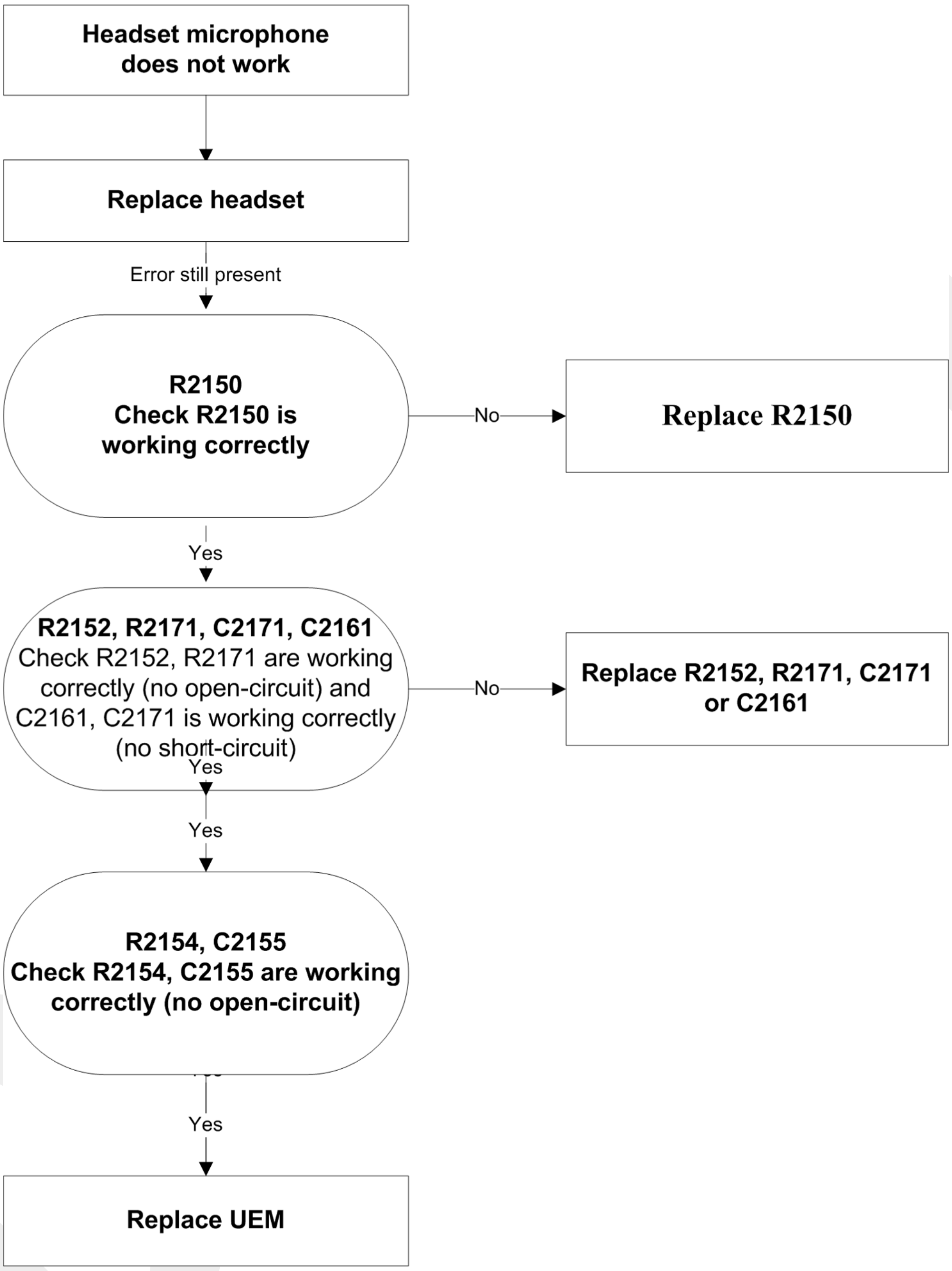
Headset microphone does not work
Replace headset
Error still present
R2150
Check R2150 is working correctly
No
Replace R2150
Yes
R2152, R2171, C2171, C2161
Check R2152, R2171 are working correctly (no open-circuit) and C2161, C2171 is working correctly (no short-circuit)
No
Replace R2152, R2171, C2171 or C2161
Yes
Yes
R2154, C2155
Check R2154, C2155 are working correctly (no open-circuit)
Yes
Replace UEM

Figure 28 Headset microphone fault flow chart

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4 — RF Troubleshooting Instructions

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General RF troubleshooting

General RF troubleshooting

Most RF semiconductors are static discharge sensitive

Two types of measurements are used in the following. It will be specified if the measurement type is "RF" or "LF".

- RF measurements are done with a Spectrum Analyzer and a high-frequency 500 ohm passive probe, for example HP54006A. (Note that when measuring with the 500ohm probe the signal will be around 20dB attenuated. The values in the following will have these 20dB subtracted and represent the real value seen on the spectrum analyzer). Note that the testing have some losses which must be taken into consideration when calibrating the test system.
- LF (Low frequency) and DC measurements should be done with a 10:1 probe and an oscilloscope. The probe used in the following is 10Mohm/8pF passive probe. If using another probe then bear in mind that the voltages displayed may be slightly different. Always make sure the measurement set-up is calibrated when measuring RF parameters on the antenna pad. Remember to include the loss in the module repair jig when realigning the phone.

So ESD protection must be applied during repair (ground straps and ESD soldering irons). Mjoelner and Bifrost are moisture sensitive so parts must be pre-baked prior to soldering. Apart from key-components described in this document there are a lot of discrete components (resistors, inductors and capacitors) for which troubleshooting is done by checking if soldering of the component is done properly and checking if the component is missing from PWB. Capacitors can be checked for short-circuiting and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully. In the following both the name EGSM and GSM850 will be used for the lower band and both PCN and GSM1900 will be used for the upper band.

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RF key components

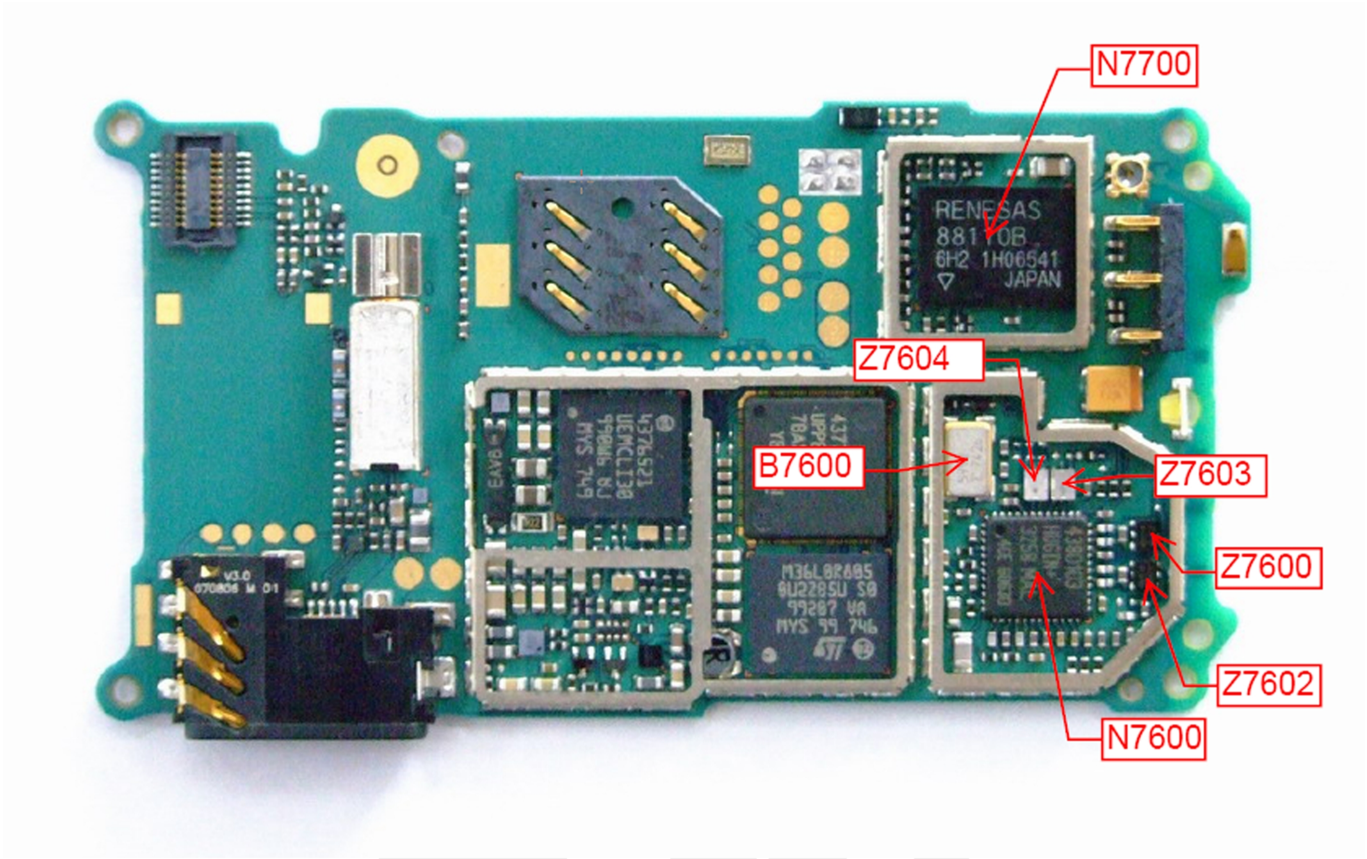

Figure 29 RF key components on PWB

N7600	Mjoelner RF IC
N7700	FEM (PA and antenna switch)
Z7602	EGSM 850/900 RX SAW filter
Z7600	DCS 1800/PCS1900 RX SAW filter
Z7603	EGSM 850/900 TX filter
Z7604	DCS 1800/PCS1900 TX filter
B7600	26 MHz crystal

Refer to the picture below for measuring points at the UEM (D2200).

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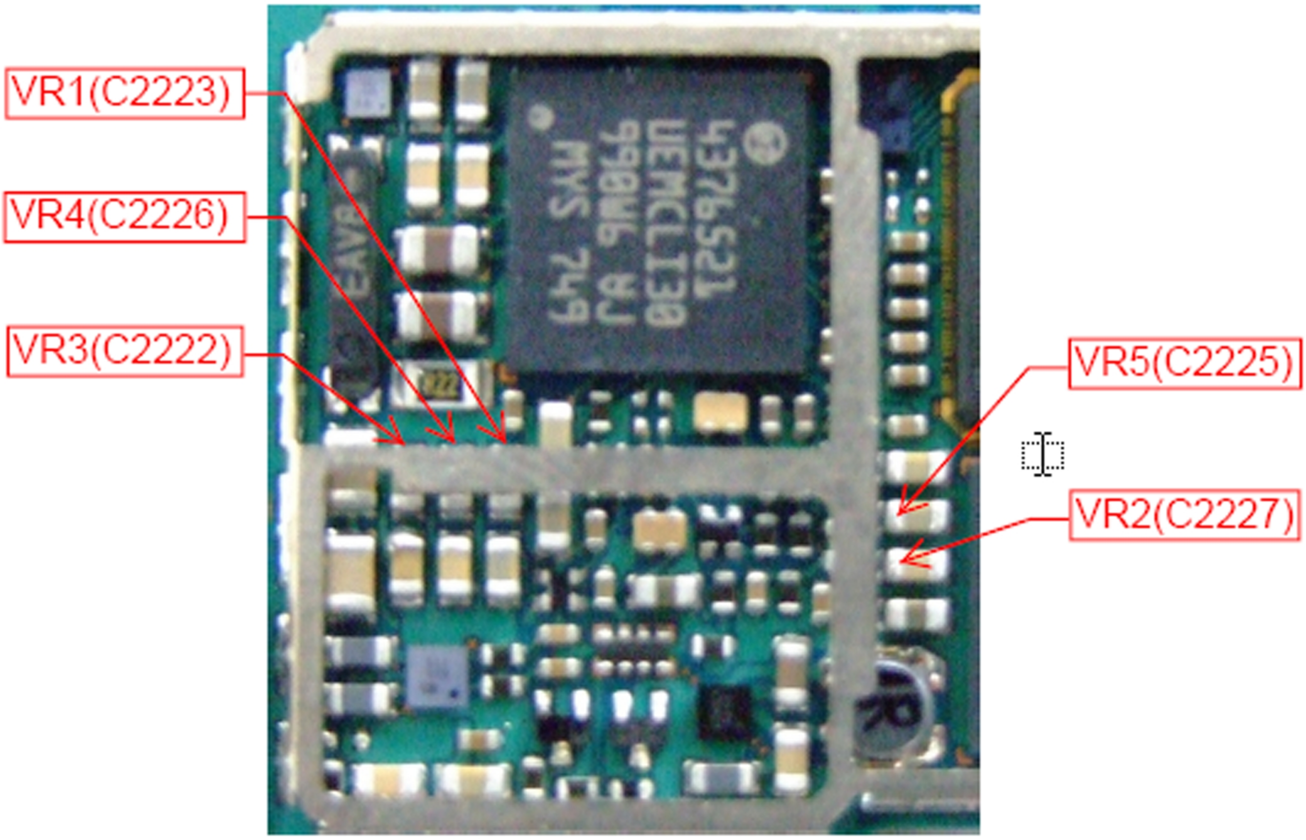
VR1(C2223)
VR4(C2226)
VR3(C2222)
VR5(C2225)
VR2(C2227)

Figure 30 Supply points at UEM (D2200)

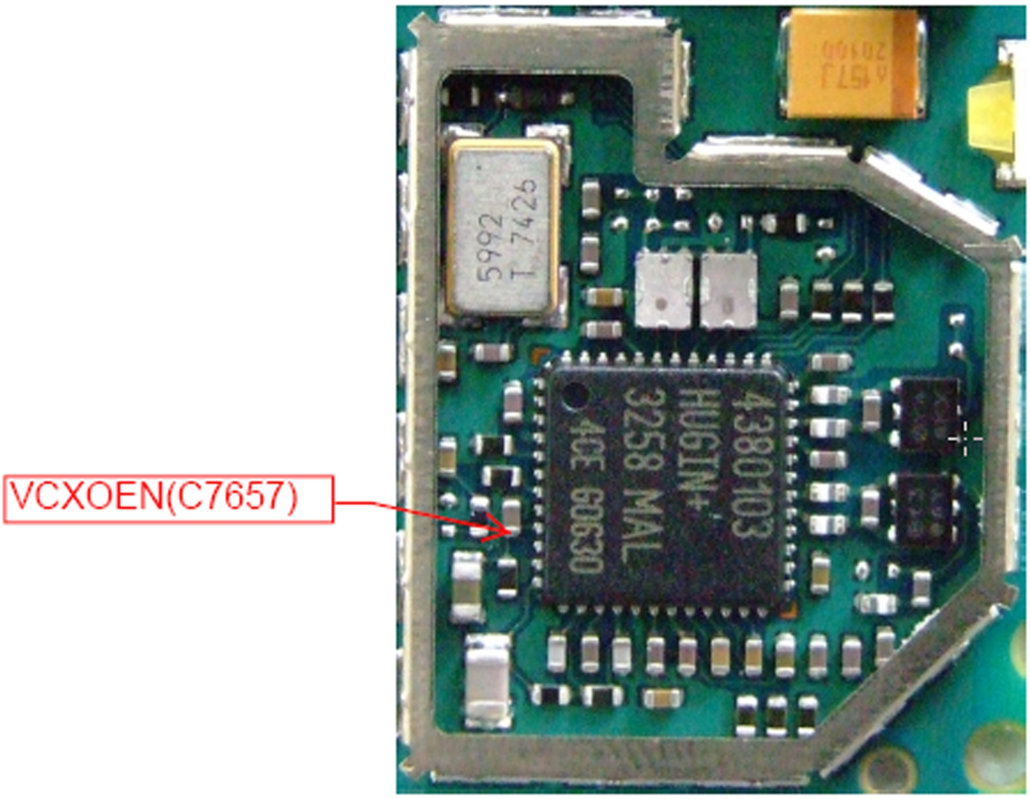
VCXOEN(C7657)

Figure 31 Supply point at RF IC (N7600)

Auto tuning

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/NT) with GPIB card
- Power supply
- Product specific module jig
- Cables: 3 (alt.1) RF cable, 1 GPIB cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

Phoenix preparations

Copy the two phone specific ini-files, for example *rm_13_tunings.ini* and *autotune_RM-13.ini,* to a phone specific folder, for example *|Phoenix|products|RM-13|*.

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.

2 The first time you are using automatic tuning on this phone model, on this computer, you will have to *Set loss* for cables and jigs.

3 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.

4 If you need more assistance, please refer to the Phoenix *Help*.

RH-116 receiver

General instructions for GSM900 RX troubleshooting

Steps

1. Connect the phone to a PC with the module repair jig.
2. Start *Phoenix* and establish a connection to the phone with the data cable e.g. FBUS.
3. Select File and Scan product.
4. Wait a while for the PC to read the information from the phone.
5. Select Testing and RF Controls.
6. Set the parameters as follows:
    i Active Unit: RX
    ii Band: GSM 900
    iii Operation Mode: Continuous mode
    iv RX/TX Channel 37
    v AGC: 8: FEG_ON + DTOS_ON+BB_6=Vgain_36

Results

The setup should now look like this:

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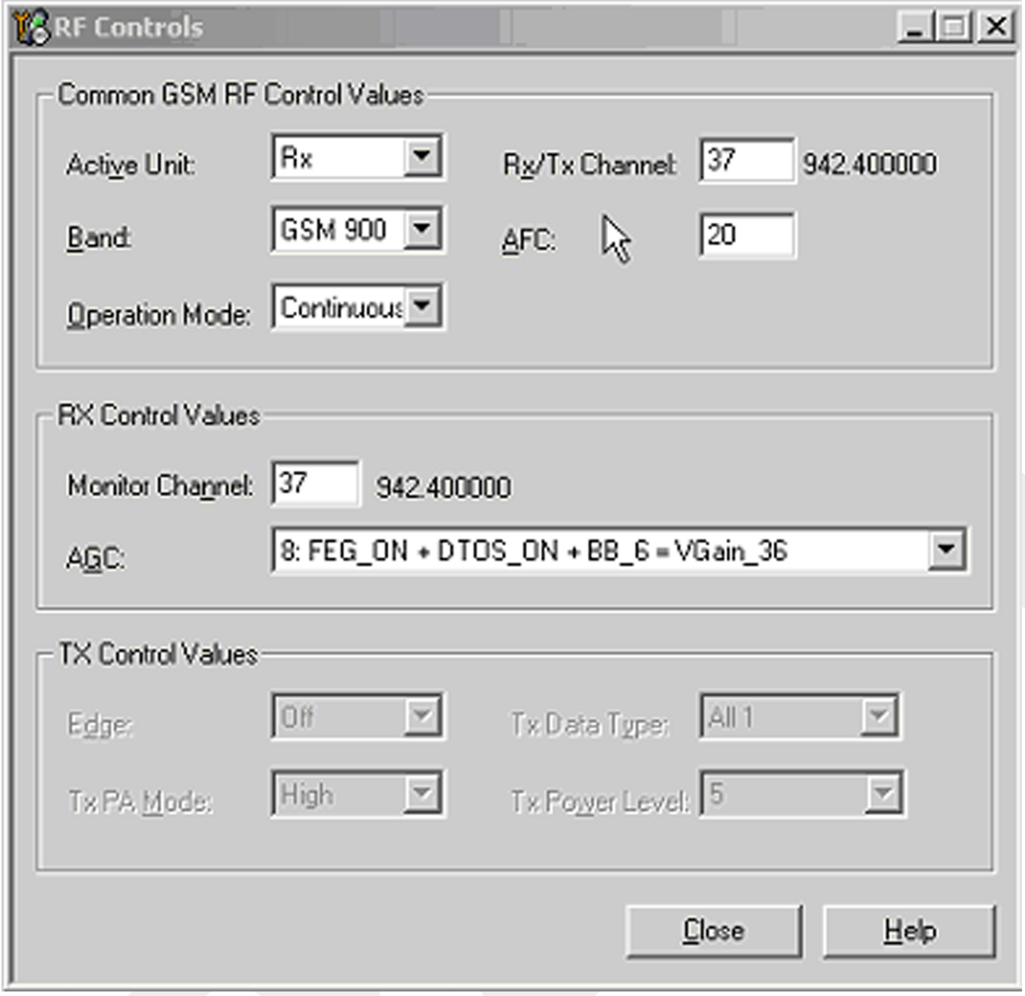

Common GSM RF Control Values

Active Unit: Rx

Rx/Tx Channel: 37 942.400000

Band: GSM 900

AFC: 20

Operation Mode: Continuous

RX Control Values

Monitor Channel: 37 942.400000

AGC: 8: FEG_ON + DTOS_ON + BB_6 = VGain_36

TX Control Values

Edge: Off

Tx Data Type: All 1

Tx PA Mode: High

Tx Power Level: 5

Figure 32 GSM900 RF controls window

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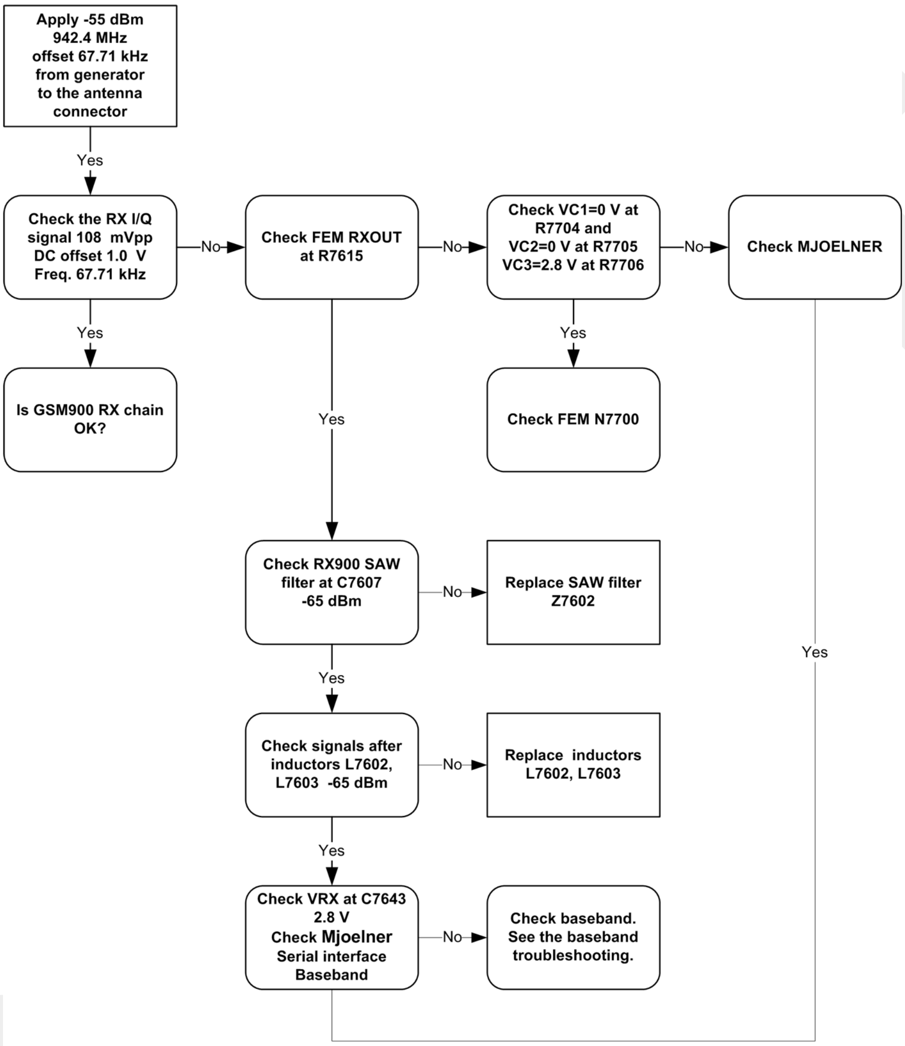
Troubleshooting diagram for GSM900 receiver

Troubleshooting flow


Apply -55 dBm
942.4 MHz
offset 67.71 kHz
from generator
to the antenna
connector
Yes
Check the RX I/Q signal 108 mVpp DC offset 1.0 V Freq. 67.71 kHz
No
Check FEM RXOUT at R7615
No
Check VC1=0 V at R7704 and VC2=0 V at R7705 VC3=2.8 V at R7706
No
Check MJOELNER
Yes
Is GSM900 RX chain OK?
Yes
Yes
Check FEM N7700
Check RX900 SAW filter at C7607 -65 dBm
No
Replace SAW filter Z7602
Yes
Yes
Check signals after inductors L7602, L7603 -65 dBm
No
Replace inductors L7602, L7603
Yes
Check VRX at C7643 2.8 V Check Mjoelner Serial interface Baseband
No
Check baseband. See the baseband troubleshooting.

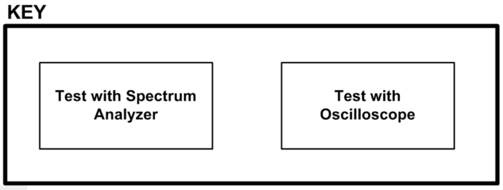

KEY
Test with Spectrum Analyzer
Test with Oscilloscope

Figure 33 GSM900 receiver troubleshooting

Results

By measuring with an oscilloscope at RXIP or RXQP on a working GSM900 receiver this picture should be seen. Signal amplitude peak-peak 108mV. DC offset 1.0V.

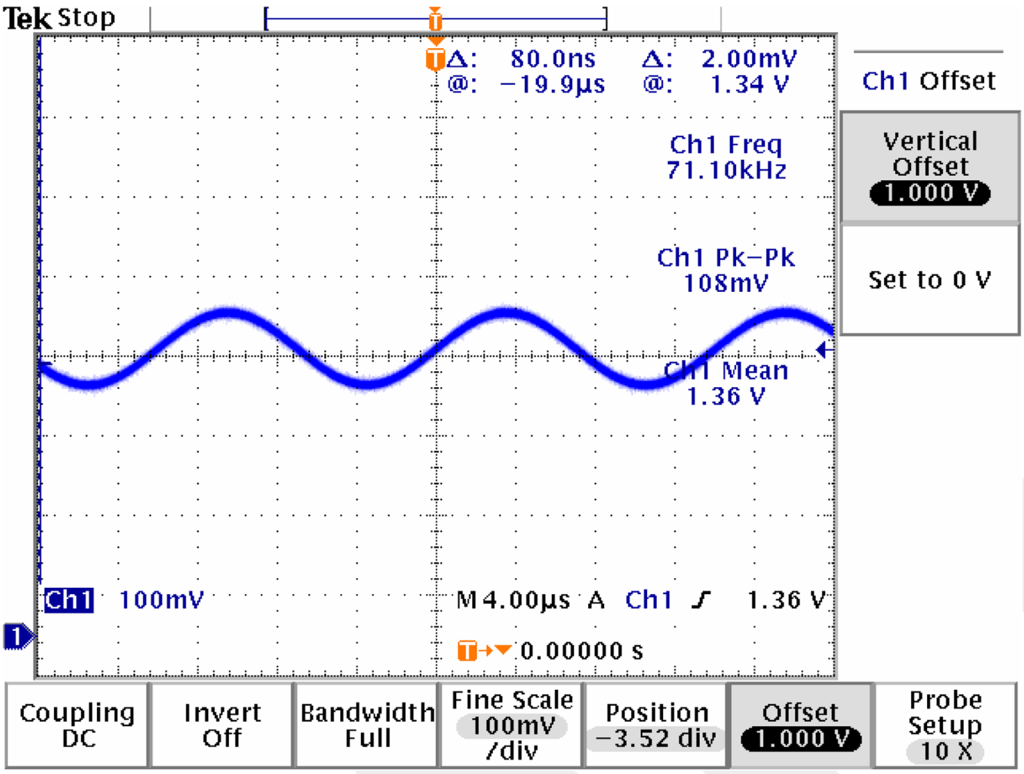

Tek Stop
Δ: 80.0ns
@: −19.9µs
Δ: 2.00mV
@: 1.34 V
Ch1 Freq
71.10kHz
Ch1 Pk−Pk
108mV
Ch1 Mean
1.36 V
Ch1 100mV
M 4.00µs A Ch1 ∫ 1.36 V
0.00000 s
Ch1 Offset
Vertical Offset 1.000 V
Set to 0 V
Coupling DC
Invert Off
Bandwidth Full
Fine Scale 100mV /div
Position −3.52 div
Offset 1.000 V
Probe Setup 10 X

Figure 34 900 RX I/Q signal waveform

General instructions for GSM 1800 RX troubleshooting

Steps

1. Connect the phone to a PC with the module repair jig.
2. Start *Phoenix* and establish a connection to the phone with the data cable e.g. FBUS.
3. Select File and Scan product.
4. Wait a while for the PC to read the information from the phone.
5. Select Testing and RF Controls.
6. Set the parameters as follows:
   - i Active Unit: RX
   - ii Band: GSM 1800
   - iii Operation Mode: Continuous mode
   - iv RX/TX Channel 700
   - v AGC: 8: FEG_ON + DTOS_ON+BB_6=Vgain_36

Results

The setup should now look like this:

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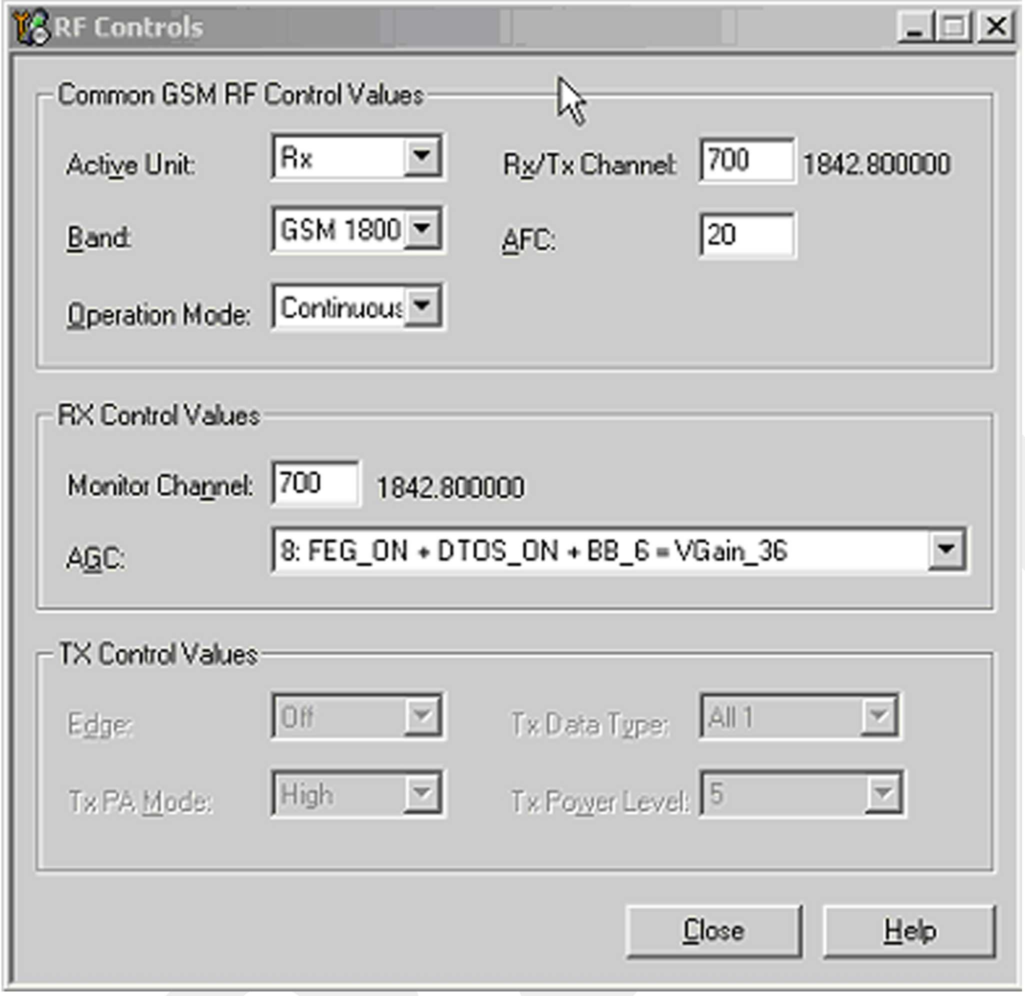
RF Controls
Common GSM RF Control Values
RX Control Values
TX Control Values
Close
Help

Active Unit: Rx
Rx/Tx Channel: 700 1842.800000
Band: GSM 1800
AFC: 20
Operation Mode: Continuous
Monitor Channel: 700 1842.800000
AGC: 8: FEG_ON + DTOS_ON + BB_6 = VGain_36
Edge: Off
Tx Data Type: All 1
Tx PA Mode: High
Tx Power Level: 5

Figure 35 GSM1800 RF controls window

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Troubleshooting diagram for GSM1800 receiver

Troubleshooting flow

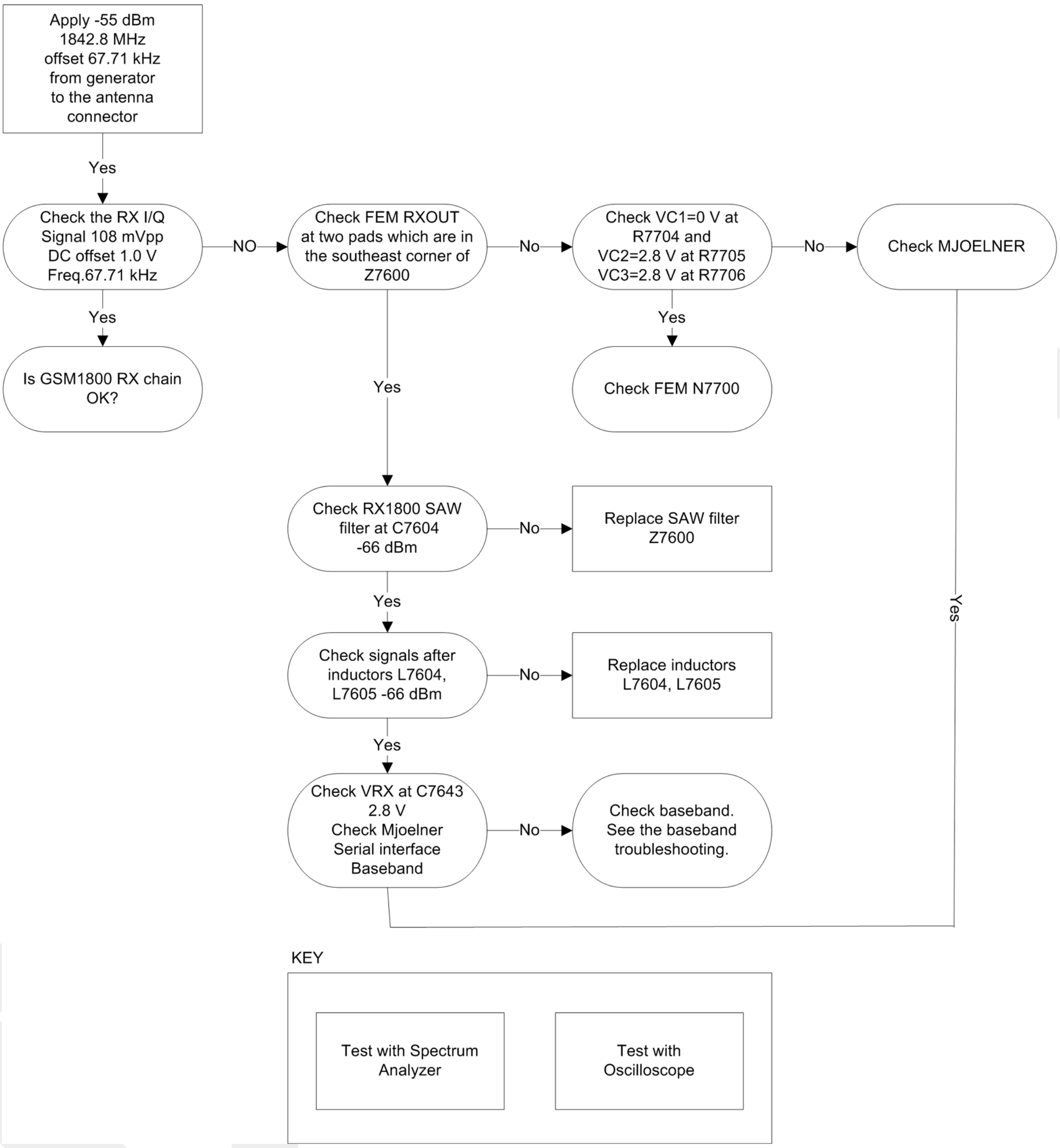
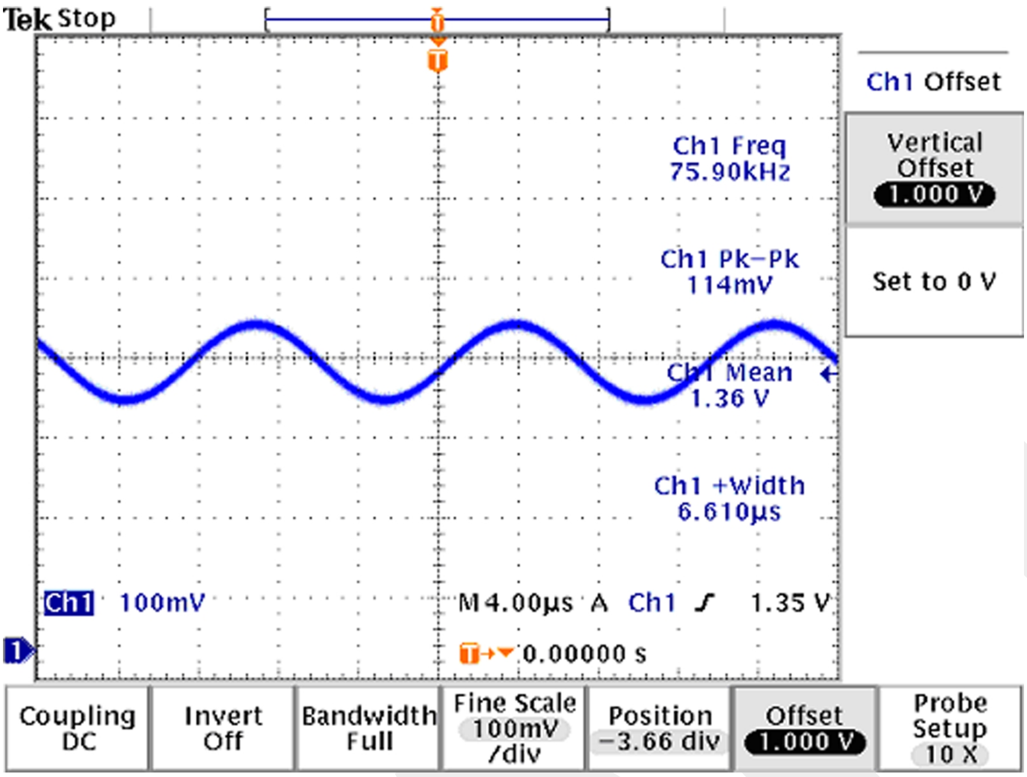

Apply -55 dBm 1842.8 MHz offset 67.71 kHz from generator to the antenna connector
Yes
Check the RX I/Q Signal 108 mVpp DC offset 1.0 V Freq.67.71 kHz
NO
Check FEM RXOUT at two pads which are in the southeast corner of Z7600
No
Check VC1=0 V at R7704 and VC2=2.8 V at R7705 VC3=2.8 V at R7706
No
Check MJOELNER
Yes
Is GSM1800 RX chain OK?
Yes
Yes
Check FEM N7700
Check RX1800 SAW filter at C7604 -66 dBm
No
Replace SAW filter Z7600
Yes
Yes
Check signals after inductors L7604, L7605 -66 dBm
No
Replace inductors L7604, L7605
Yes
Check VRX at C7643 2.8 V Check Mjoelner Serial interface Baseband
No
Check baseband. See the baseband troubleshooting.
KEY
Test with Spectrum Analyzer
Test with Oscilloscope

Figure 36 GSM1800 receiver troubleshooting

Results

By measuring with an oscilloscope at RXIP or RXQP on a working GSM1800 receiver this picture should be seen. Signal amplitude peak-peak 114mV. DC offset 1.0V.


Tek Stop
Ch1 Offset
Set to 0 V
Ch1 100mV
1

Ch1 Freq 75.90kHz

Ch1 Pk−Pk 114mV

Ch1 Mean 1.36 V

Ch1 +Width 6.610µs

M 4.00µs A Ch1 ∫ 1.35 V

T→▼0.00000 s

Vertical Offset 1.000 V

Coupling DC

Invert Off

Bandwidth Full

Fine Scale 100mV /div

Position −3.66 div

Offset 1.000 V

Probe Setup 10 X

Figure 37 1800 RX I/Q signal waveform

Measurement points in the receiver

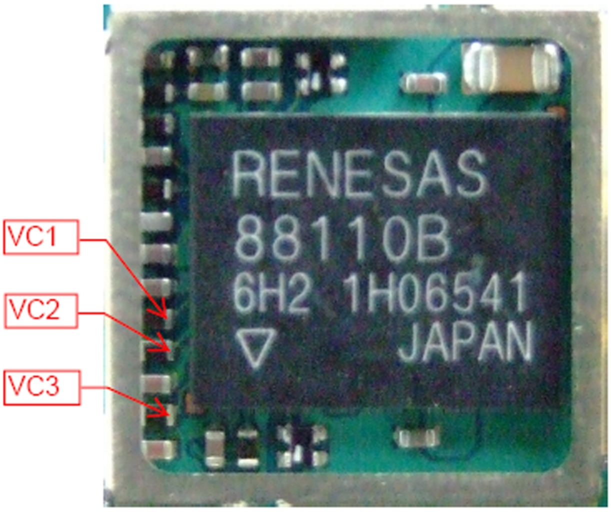

VC1
VC2
VC3
RENESAS
88110B
6H2 1H06541
JAPAN

Figure 38 RX measurements point of the control voltages to FEM N7700

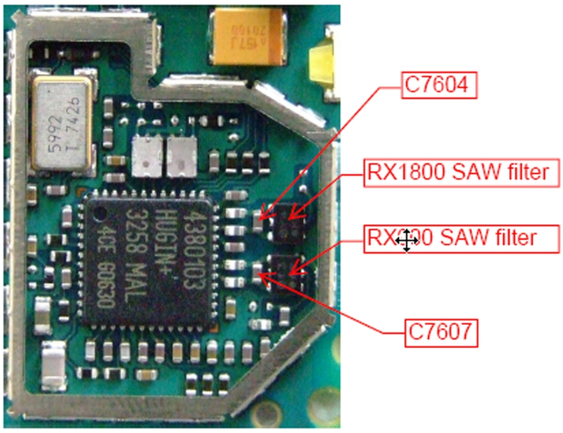


Figure 39 Measurement points at the RX SAW Filters – Z7600/Z7602

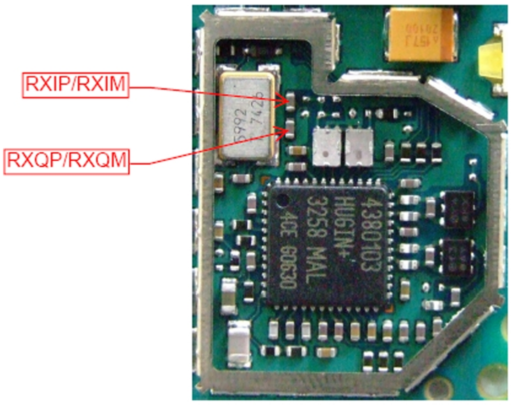


Figure 40 RX I/Q signals

RH-116 transmitter

General instructions for GSM 900 TX troubleshooting

Steps

1. Apply a RF-cable to the RF-connector to allow the transmitted signal act as normal. RF-cable should be connected to an attenuator at least 10dB before connected to the measurement equipment, otherwise the PA may be damaged.
2. Start *Phoenix* and establish a connection to the phone with the data cable e.g. FBUS.
3. Select File and Scan product.
4. Wait a while for the PC to read the information from the phone.
5. Select Testing and RF Controls.
6. Set the parameters as follows:
    - i Band: GSM 900
    - ii Active Unit: TX
    - iii TX Power Level: 5
    - iv TX Data Type: Random

Results

The setup should now look like this:

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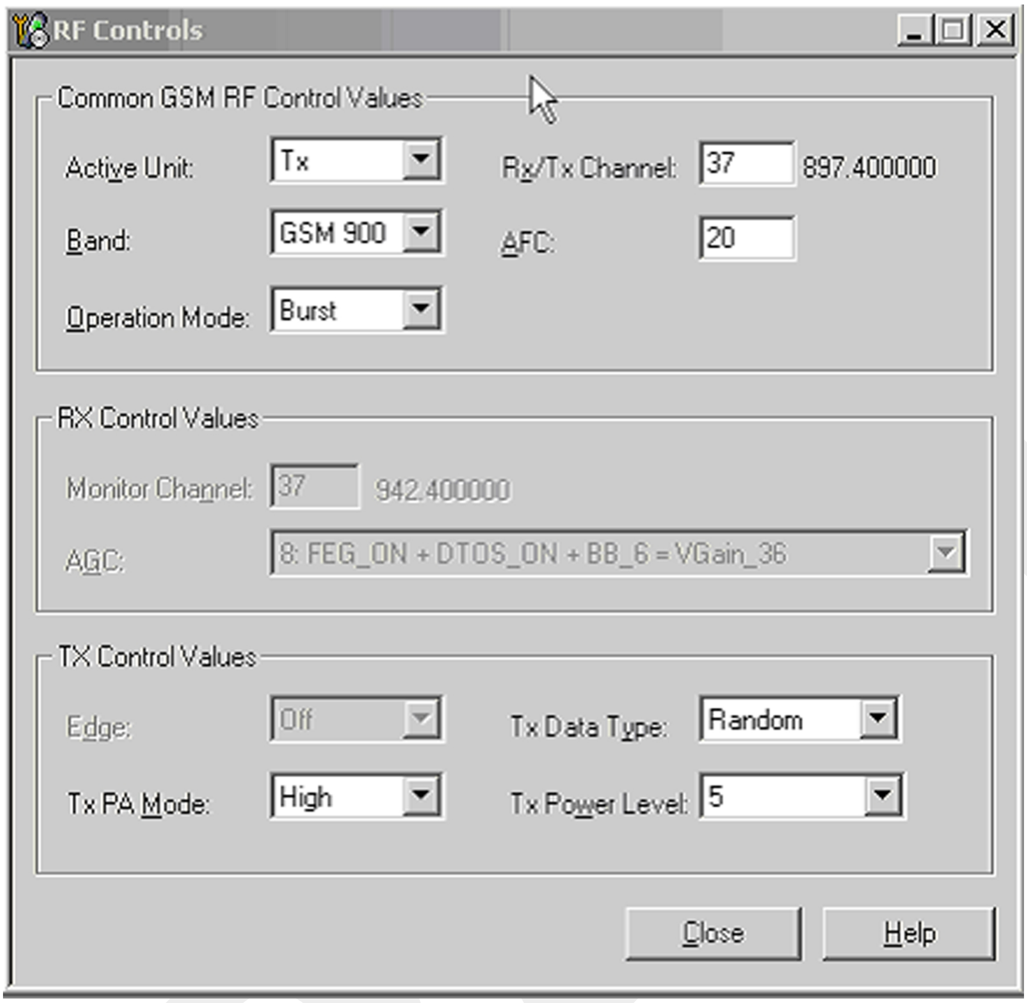

RF Controls

Common GSM RF Control Values

Active Unit: Tx
Band: GSM 900
Operation Mode: Burst
Rx/Tx Channel: 37 897.400000
AFC: 20

RX Control Values

Monitor Channel: 37 942.400000
AGC: 8: FEG_ON + DTOS_ON + BB_6 = VGain_36

TX Control Values

Edge: Off
Tx PA Mode: High
Tx Data Type: Random
Tx Power Level: 5

Figure 41 GSM 900 RF controls window

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Troubleshooting diagram for GSM900 transmitter

Troubleshooting flow

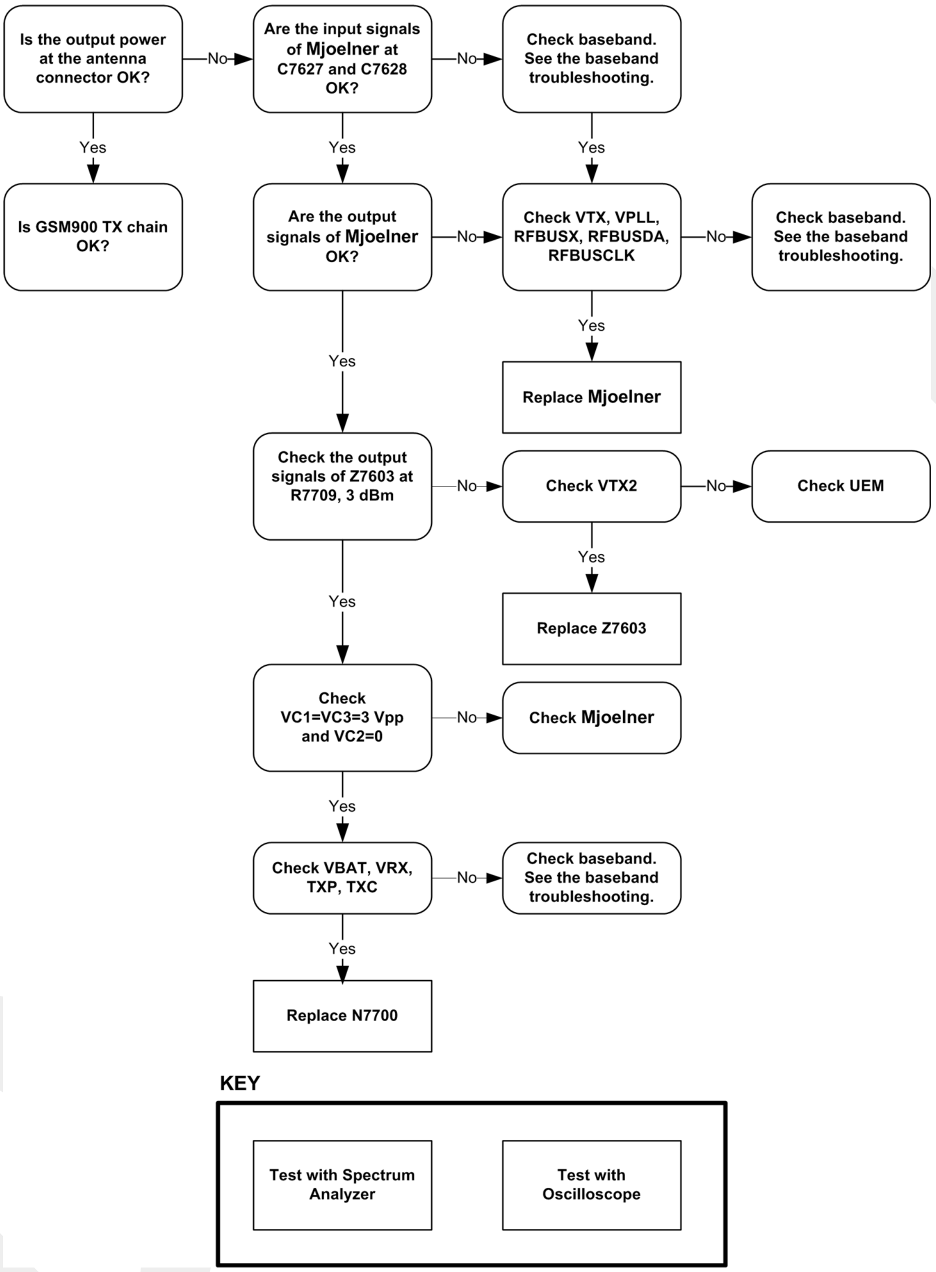
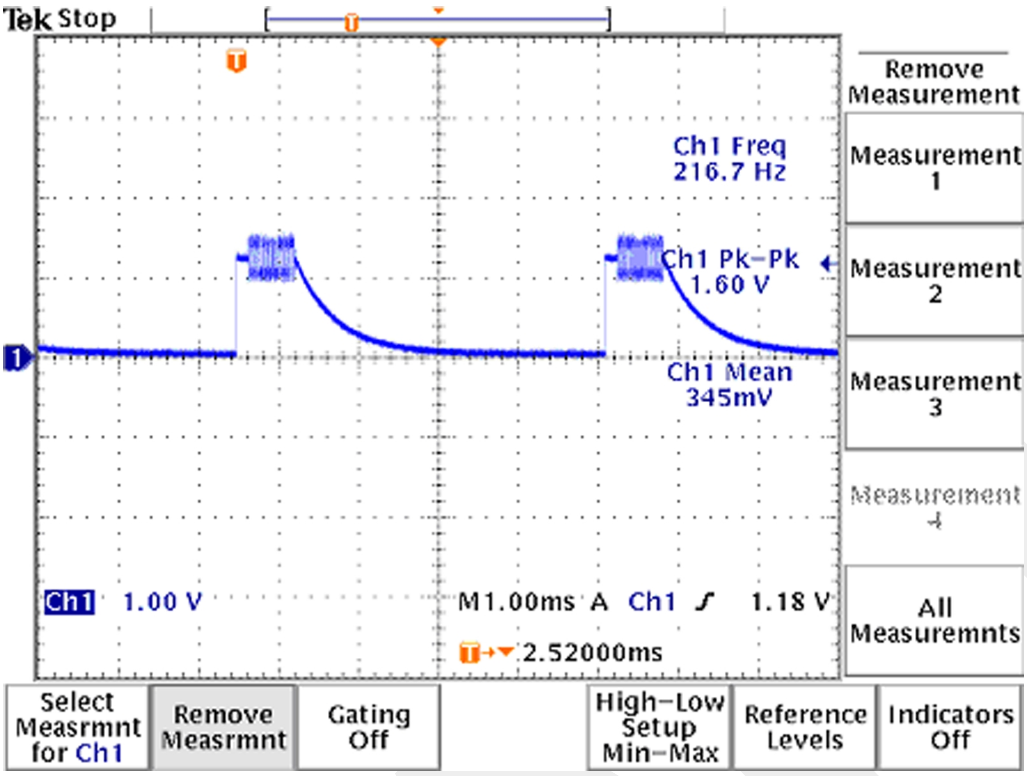

Is the output power at the antenna connector OK?
No
Are the input signals of Mjoelner at C7627 and C7628 OK?
No
Check baseband. See the baseband troubleshooting.
Yes
Yes
Yes
Is GSM900 TX chain OK?
Are the output signals of Mjoelner OK?
No
Check VTX, VPLL, RFBUSX, RFBUSDA, RFBUSCLK
No
Check baseband. See the baseband troubleshooting.
Yes
Yes
Replace Mjoelner
Check the output signals of Z7603 at R7709, 3 dBm
No
Check VTX2
No
Check UEM
Yes
Yes
Replace Z7603
Check VC1=VC3=3 Vpp and VC2=0
No
Check Mjoelner
Yes
Check VBAT, VRX, TXP, TXC
No
Check baseband. See the baseband troubleshooting.
Yes
Replace N7700
KEY
Test with Spectrum Analyzer
Test with Oscilloscope

Figure 42 GSM900 tarnsmitter troubleshooting

GSM900 TX output power

Measure the output power of the phone; it should be about 32.5dBm. Remember the cable loss is about 0.3dB.



Ch1 Freq 216.7 Hz

Ch1 Pk−Pk 1.60 V

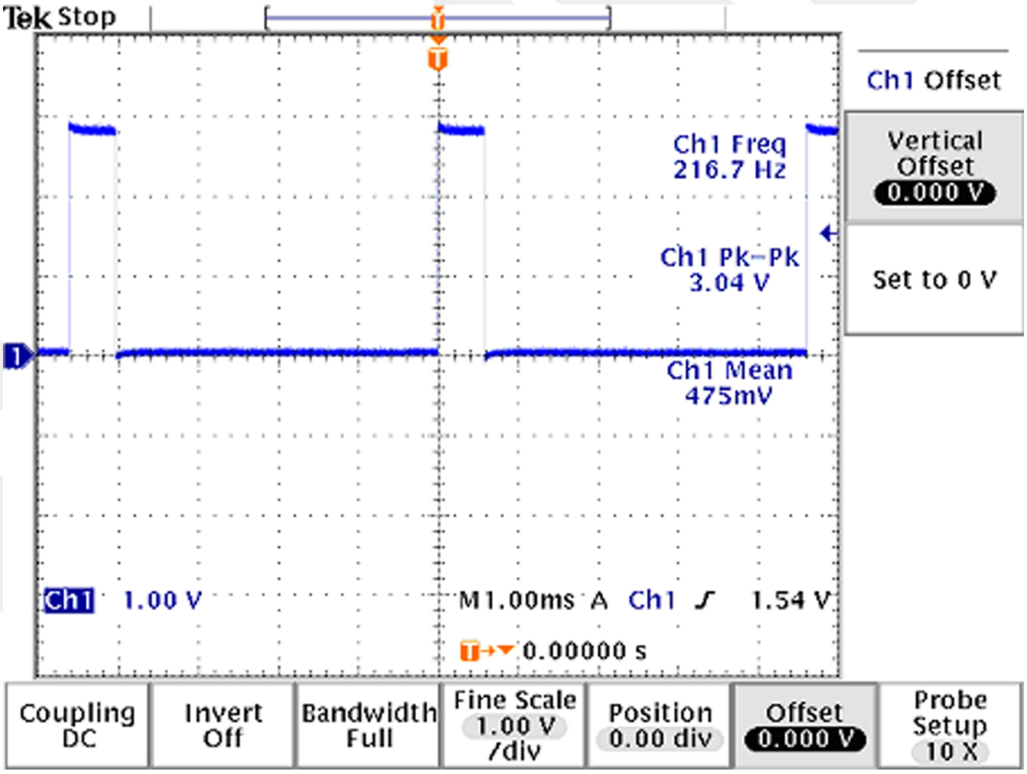
Ch1 Mean 345mV

Ch1 1.00 V M1.00ms A Ch1 ſ 1.18 V

T→▾2.52000ms

Tek Stop
Remove Measurement
Measurement 1
Measurement 2
Measurement 3
Measurement 4
All Measuremnts
Select Measrmnt for Ch1
Remove Measrmnt
Gating Off
High−Low Setup Min−Max
Reference Levels
Indicators Off

Figure 43 TX I/O signal



Ch1 Freq 216.7 Hz

Ch1 Pk−Pk 3.04 V

Ch1 Mean 475mV

Ch1 1.00 V M1.00ms A Ch1 ſ 1.54 V

T→▾0.00000 s

Coupling DC

Invert Off

Bandwidth Full

Fine Scale 1.00 V /div

Position 0.00 div

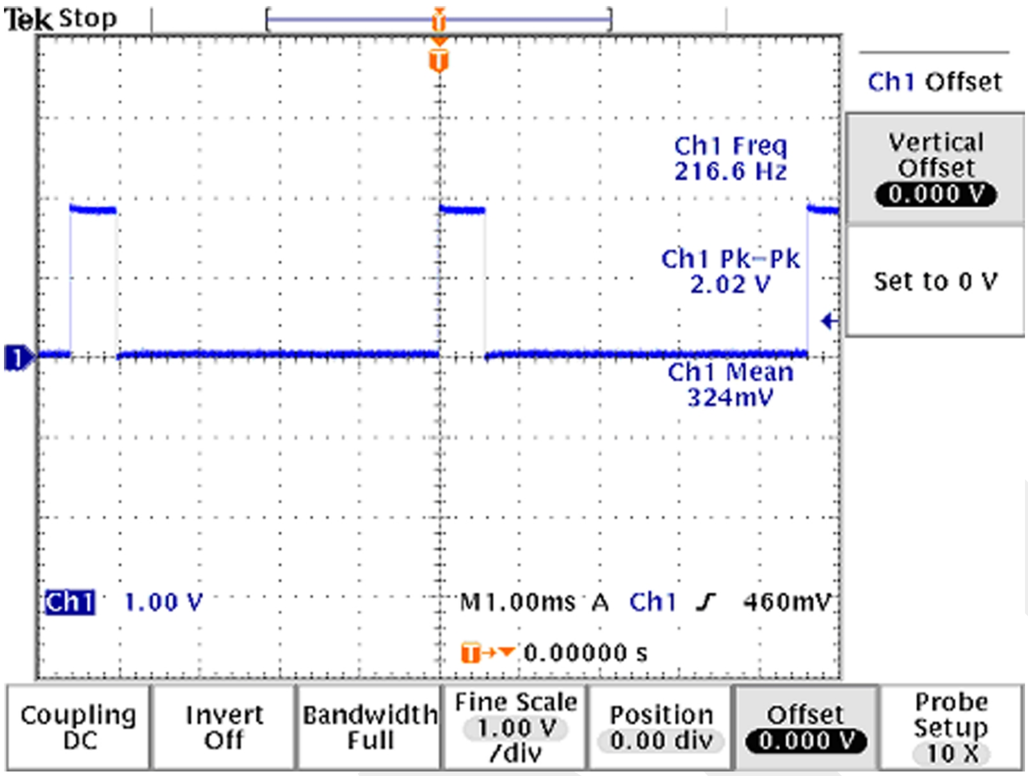
Offset 0.000 V

Probe Setup 10 X

Vertical Offset 0.000 V

Tek Stop
Ch1 Offset
Set to 0 V

Figure 44 VC1, VC3 signals


Tek Stop
Ch1 Offset
Vertical Offset 0.000 V
Set to 0 V
1
Ch1 1.00 V
M1.00ms A Ch1 ∫ 460mV
0.00000 s

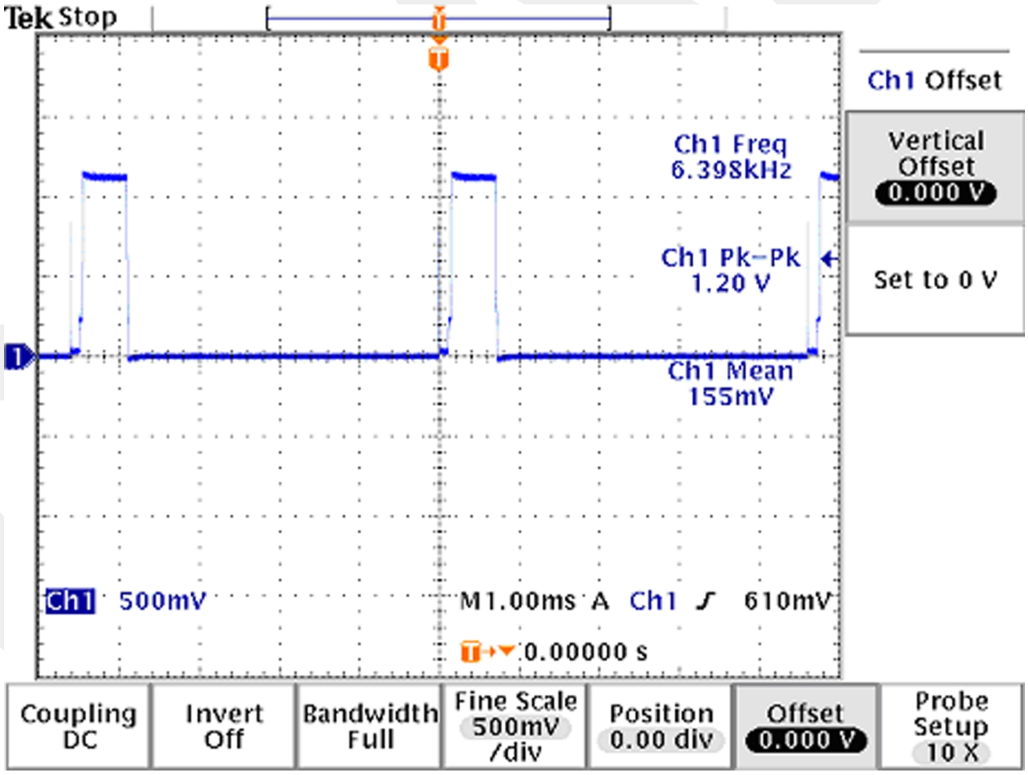
Ch1 Freq
216.6 Hz

Ch1 Pk−Pk
2.02 V

Ch1 Mean
324mV

Coupling DC
Invert Off
Bandwidth Full
Fine Scale 1.00 V /div
Position 0.00 div
Offset 0.000 V
Probe Setup 10 X

Figure 45 TXP signal


Tek Stop
Ch1 Offset
Vertical Offset 0.000 V
Set to 0 V
1
Ch1 500mV
M1.00ms A Ch1 ∫ 610mV
0.00000 s

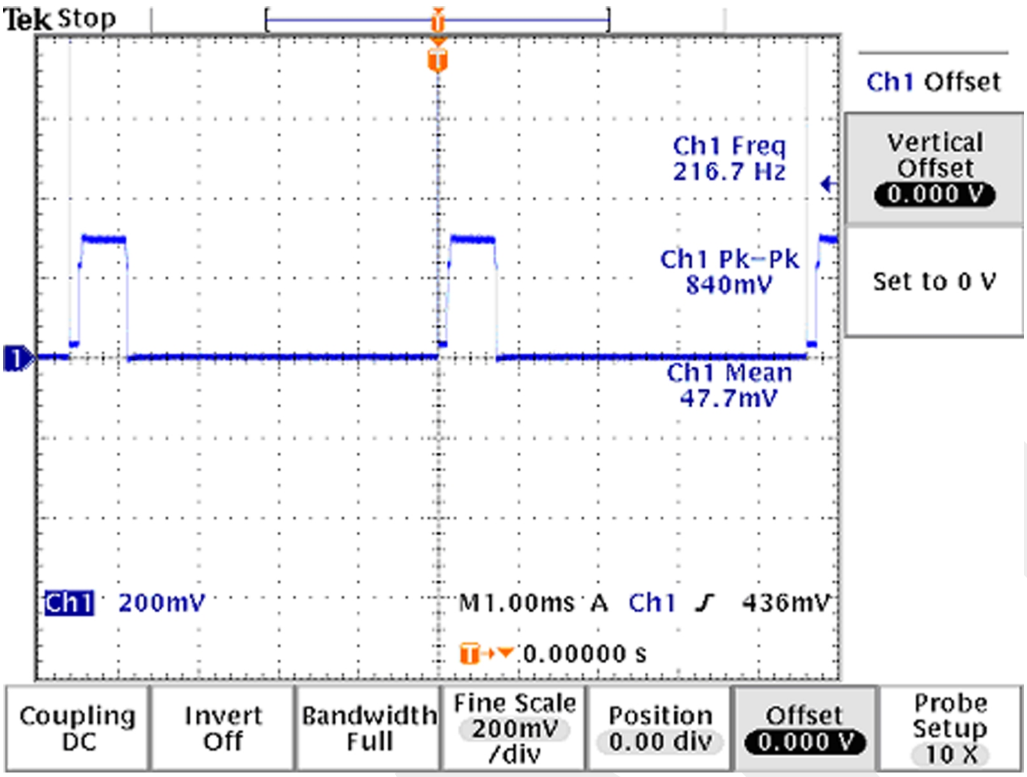
Ch1 Freq
6.398kHz

Ch1 Pk−Pk
1.20 V

Ch1 Mean
155mV

Coupling DC
Invert Off
Bandwidth Full
Fine Scale 500mV /div
Position 0.00 div
Offset 0.000 V
Probe Setup 10 X

Figure 46 TXC signals at PCL5



Ch1 Freq 216.7 Hz
Ch1 Pk−Pk 840mV
Ch1 Mean 47.7mV
Ch1 200mV
M1.00ms A Ch1 ⨍ 436mV
T→ 0.00000 s
Vertical Offset 0.000 V
Coupling DC
Invert Off
Bandwidth Full
Fine Scale 200mV /div
Position 0.00 div
Offset 0.000 V
Probe Setup 10 X

Figure 47 TXC signals at PCL19

General instructions for GSM1800 TX troubleshooting

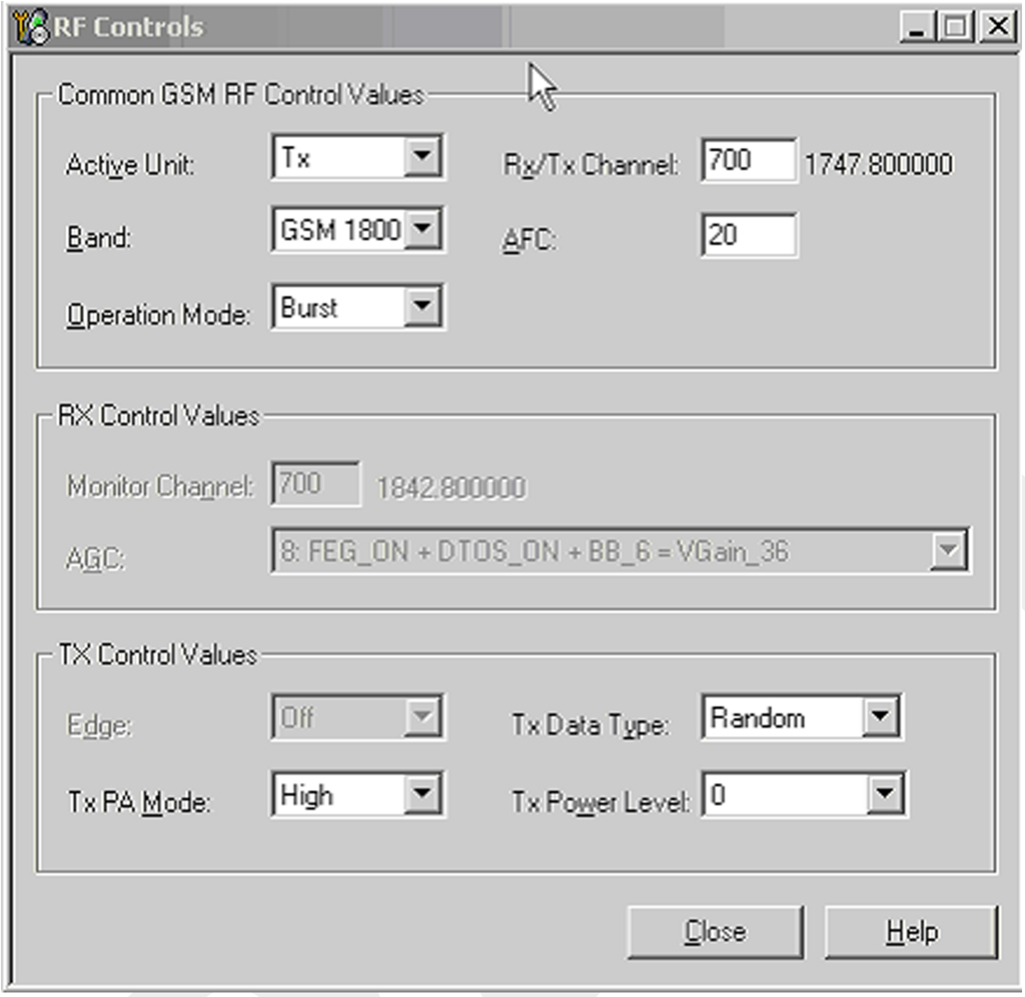
Steps

1. Apply a RF-cable to the RF-connector to allow the transmitted signal act as normal. RF-cable should be connected to an attenuator at least 10dB before connected to the measurement equipment, otherwise the PA may be damaged.
2. Start *Phoenix* and establish a connection to the phone with the data cable e.g. FBUS.
3. Select File and Scan product.
4. Wait a while for the PC to read the information from the phone.
5. Select Testing and RF Controls.
6. Set the parameters as follows:
   - i Band: GSM 1800
   - ii Active Unit: TX
   - iii TX Power Level: 0
   - iv TX Data Type: Random

Results

The setup should now look like this:

DRAFT



Common GSM RF Control Values

Active Unit: Tx

Band: GSM 1800

Operation Mode: Burst

Rx/Tx Channel: 700 1747.800000

AFC: 20

RX Control Values

Monitor Channel: 700 1842.800000

AGC: 8: FEG_ON + DTOS_ON + BB_6 = VGain_36

TX Control Values

Edge: Off

Tx PA Mode: High

Tx Data Type: Random

Tx Power Level: 0

Figure 48 GSM 1800 RF controls window

DRAFT

Troubleshooting diagram for GSM1800 transmitter

Troubleshooting flow

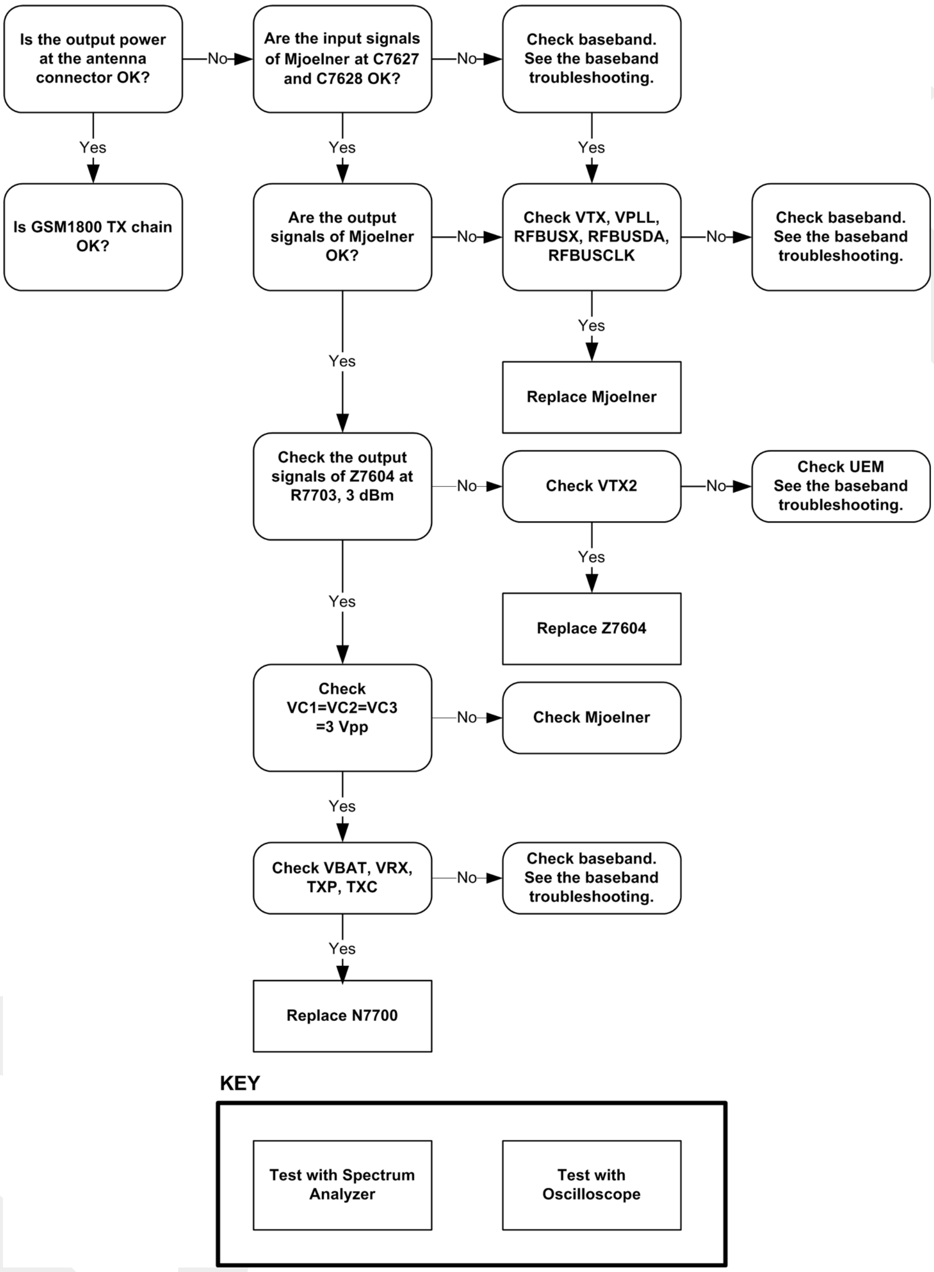
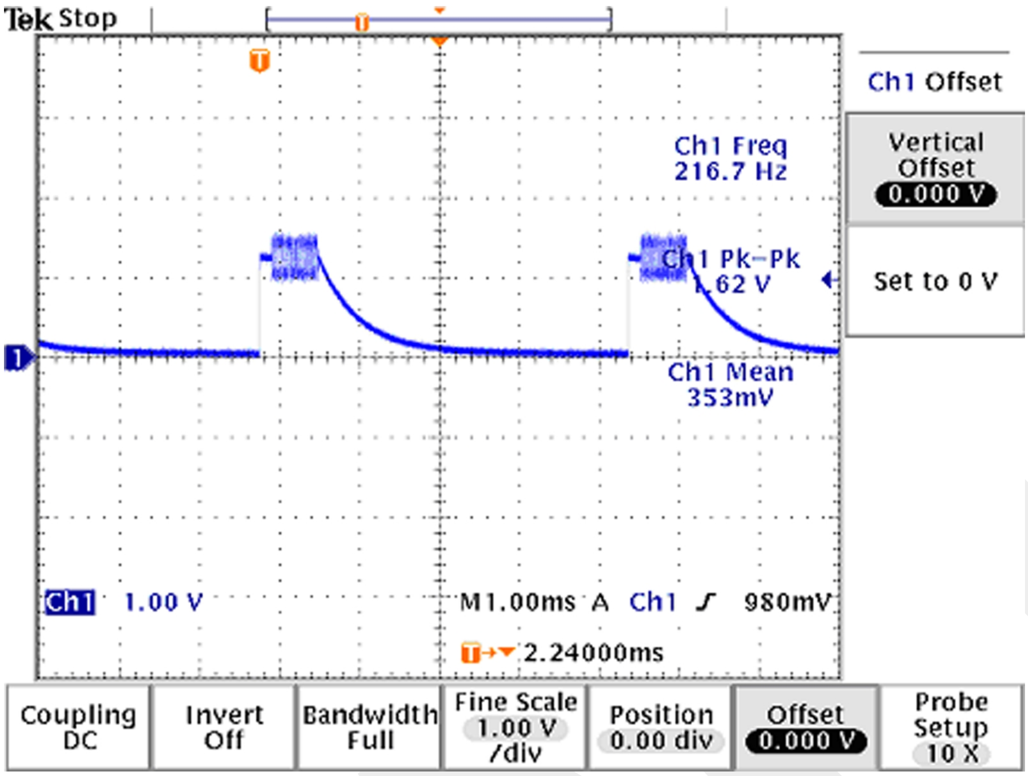

Is the output power at the antenna connector OK?
No
Are the input signals of Mjoelner at C7627 and C7628 OK?
No
Check baseband. See the baseband troubleshooting.
Yes
Is GSM1800 TX chain OK?
Yes
Are the output signals of Mjoelner OK?
No
Yes
Check VTX, VPLL, RFBUSX, RFBUSDA, RFBUSCLK
No
Check baseband. See the baseband troubleshooting.
Yes
Replace Mjoelner
Yes
Check the output signals of Z7604 at R7703, 3 dBm
No
Check VTX2
No
Check UEM See the baseband troubleshooting.
Yes
Replace Z7604
Yes
Check VC1=VC2=VC3 =3 Vpp
No
Check Mjoelner
Yes
Check VBAT, VRX, TXP, TXC
No
Check baseband. See the baseband troubleshooting.
Yes
Replace N7700
KEY
Test with Spectrum Analyzer
Test with Oscilloscope

Figure 49 GSM1800 transmitter troubleshooting

GSM1800 TX output power

Measure the output power of the phone; it should be about 29.5dBm. Remember the cable loss is about 0.5dB.



Tek Stop

Ch1 Freq 216.7 Hz

Ch1 Pk−Pk 1.62 V

Ch1 Mean 353mV

Ch1 1.00 V M1.00ms A Ch1 ⎰ 980mV

2.24000ms

Ch1 Offset

Vertical Offset 0.000 V

Set to 0 V

Coupling DC

Invert Off

Bandwidth Full

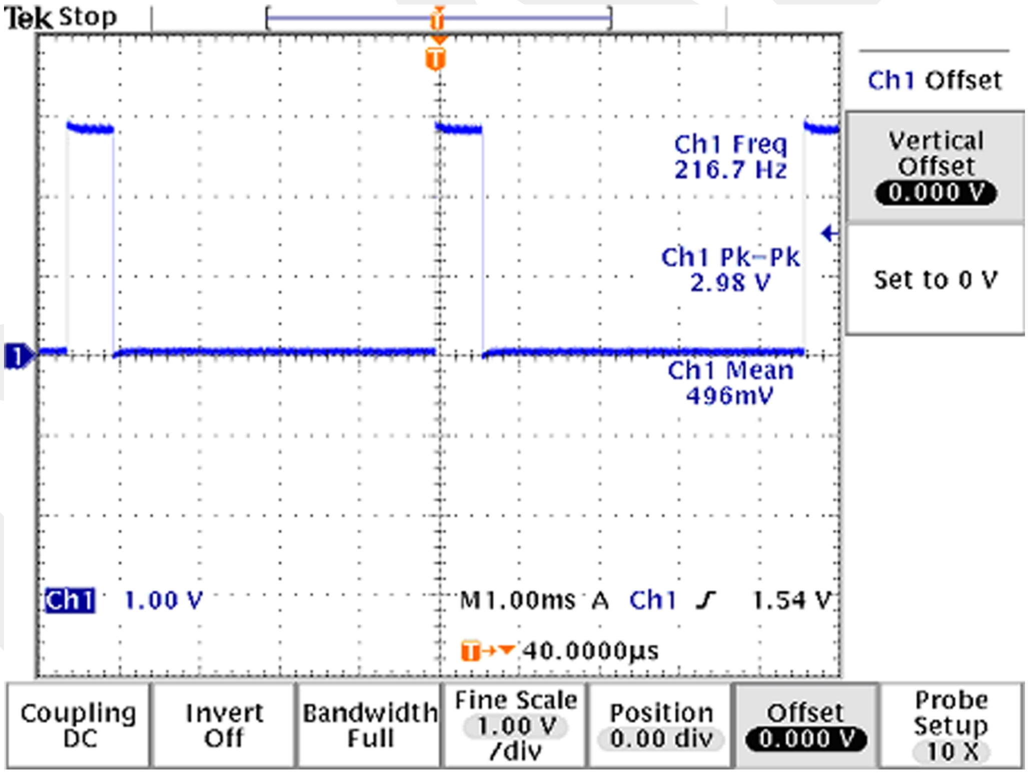
Fine Scale 1.00 V /div

Position 0.00 div

Offset 0.000 V

Probe Setup 10 X

Figure 50 TX I/O signal



Tek Stop

Ch1 Freq 216.7 Hz

Ch1 Pk−Pk 2.98 V

Ch1 Mean 496mV

Ch1 1.00 V M1.00ms A Ch1 ⎰ 1.54 V

40.0000µs

Ch1 Offset

Vertical Offset 0.000 V

Set to 0 V

Coupling DC

Invert Off

Bandwidth Full

Fine Scale 1.00 V /div

Position 0.00 div

Offset 0.000 V

Probe Setup 10 X

Figure 51 VC1, VC2, VC3 signals

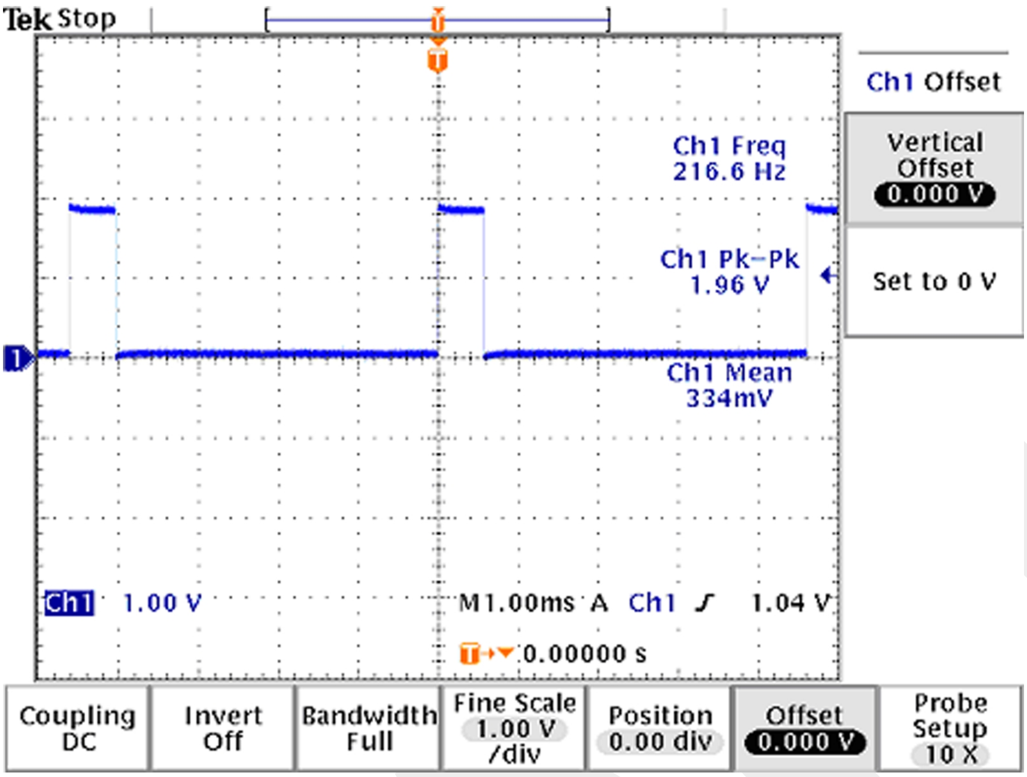


Figure 52 TXP signal

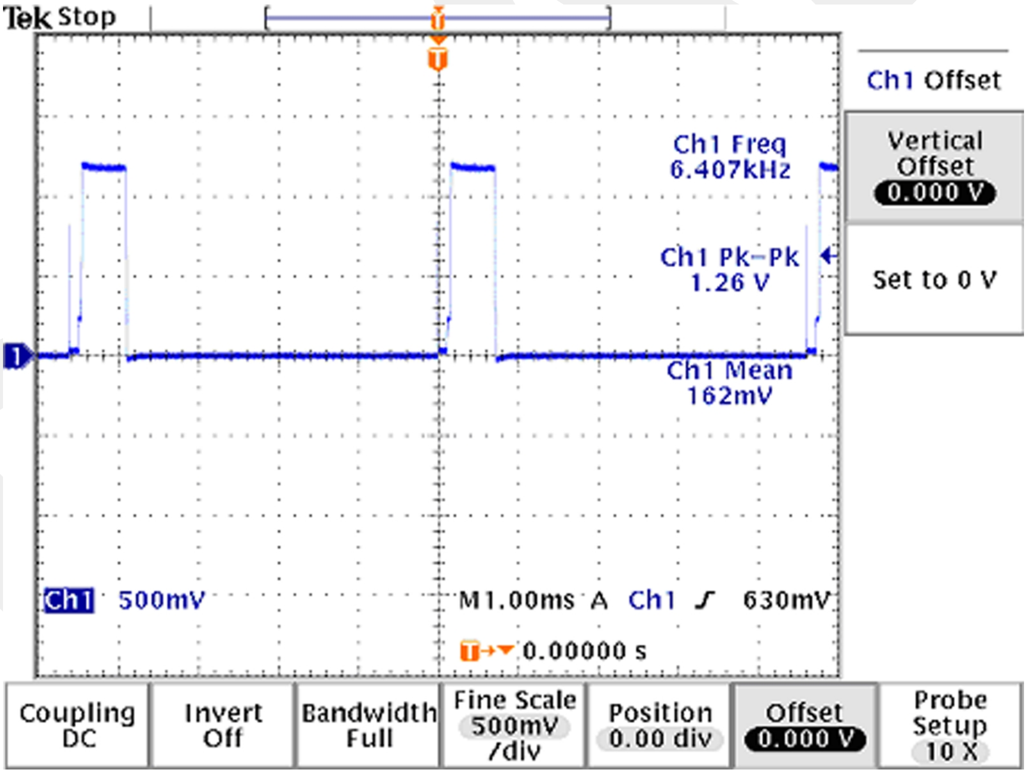


Figure 53 TXC signals at PCL0

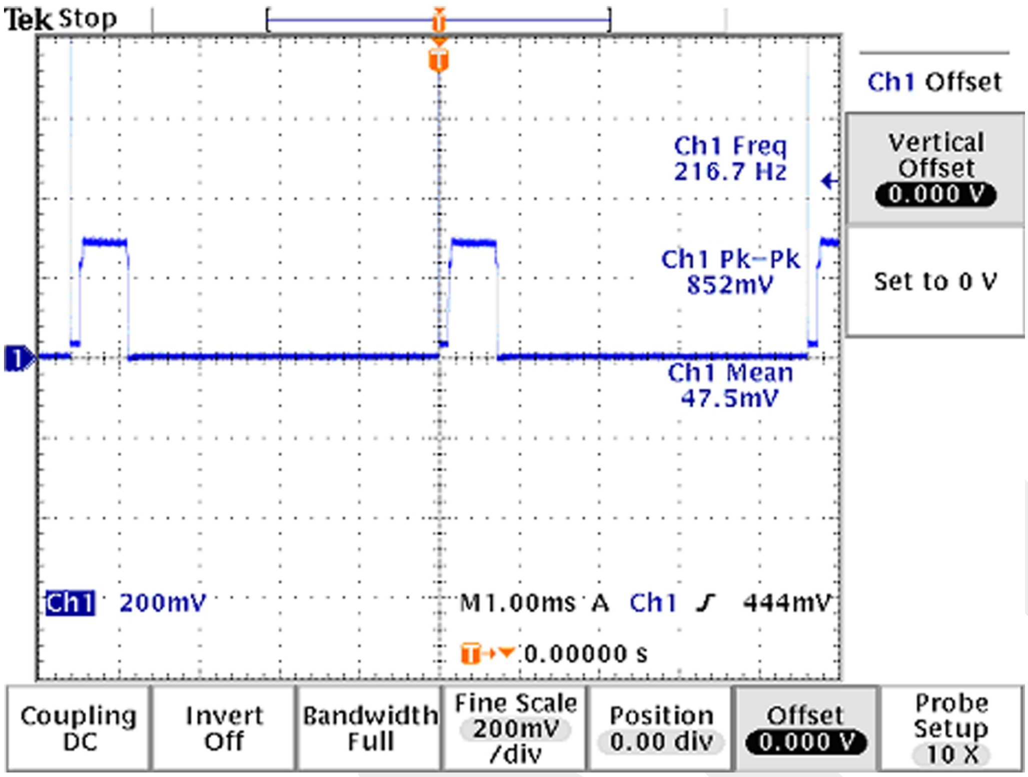

Tek Stop
Ch1 Offset
Vertical Offset 0.000 V
Set to 0 V
Ch1 Freq
216.7 Hz
Ch1 Pk-Pk
852mV
Ch1 Mean
47.5mV
Ch1 200mV
M1.00ms A Ch1 ∫ 444mV
0.00000 s
Coupling DC
Invert Off
Bandwidth Full
Fine Scale 200mV /div
Position 0.00 div
Offset 0.000 V
Probe Setup 10 X

Figure 54 TXC signals at PCL15

RH-117 receiver

General instructions for GSM 850 RX troubleshooting

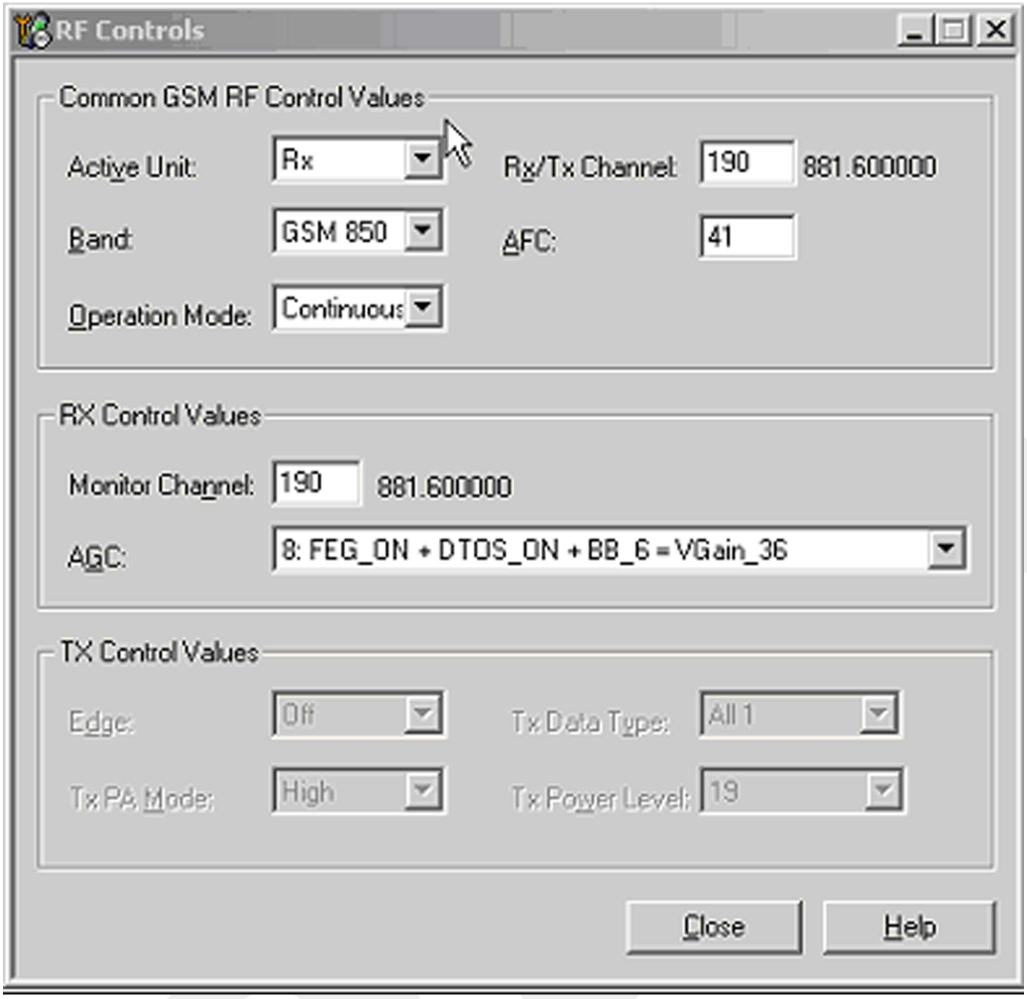
Steps

1. Connect the phone to a PC with the module repair jig.
2. Start *Phoenix* and establish a connection to the phone with the data cable e.g. FBUS.
3. Select File and Scan product.
4. Wait a while for the PC to read the information from the phone.
5. Select Testing and RF Controls.
6. Set the parameters as follows:
   i Active Unit: RX
   ii Band: GSM 850
   iii Operation Mode: Continuous mode
   iv RX/TX Channel 190
   v AGC: 8: FEG_ON + DTOS_ON+BB_6=Vgain_36

Results

The setup should now look like this:

DRAFT


RF Controls
Common GSM RF Control Values
RX Control Values
TX Control Values
Close
Help

Active Unit: Rx

Band: GSM 850

Operation Mode: Continuous

Rx/Tx Channel: 190 881.600000

AFC: 41

Monitor Channel: 190 881.600000

AGC: 8: FEG_ON + DTOS_ON + BB_6 = VGain_36

Edge: Off

Tx PA Mode: High

Tx Data Type: All 1

Tx Power Level: 19

Figure 55 GSM850 RF controls window

DRA

Troubleshooting diagram for GSM850 receiver

Troubleshooting flow

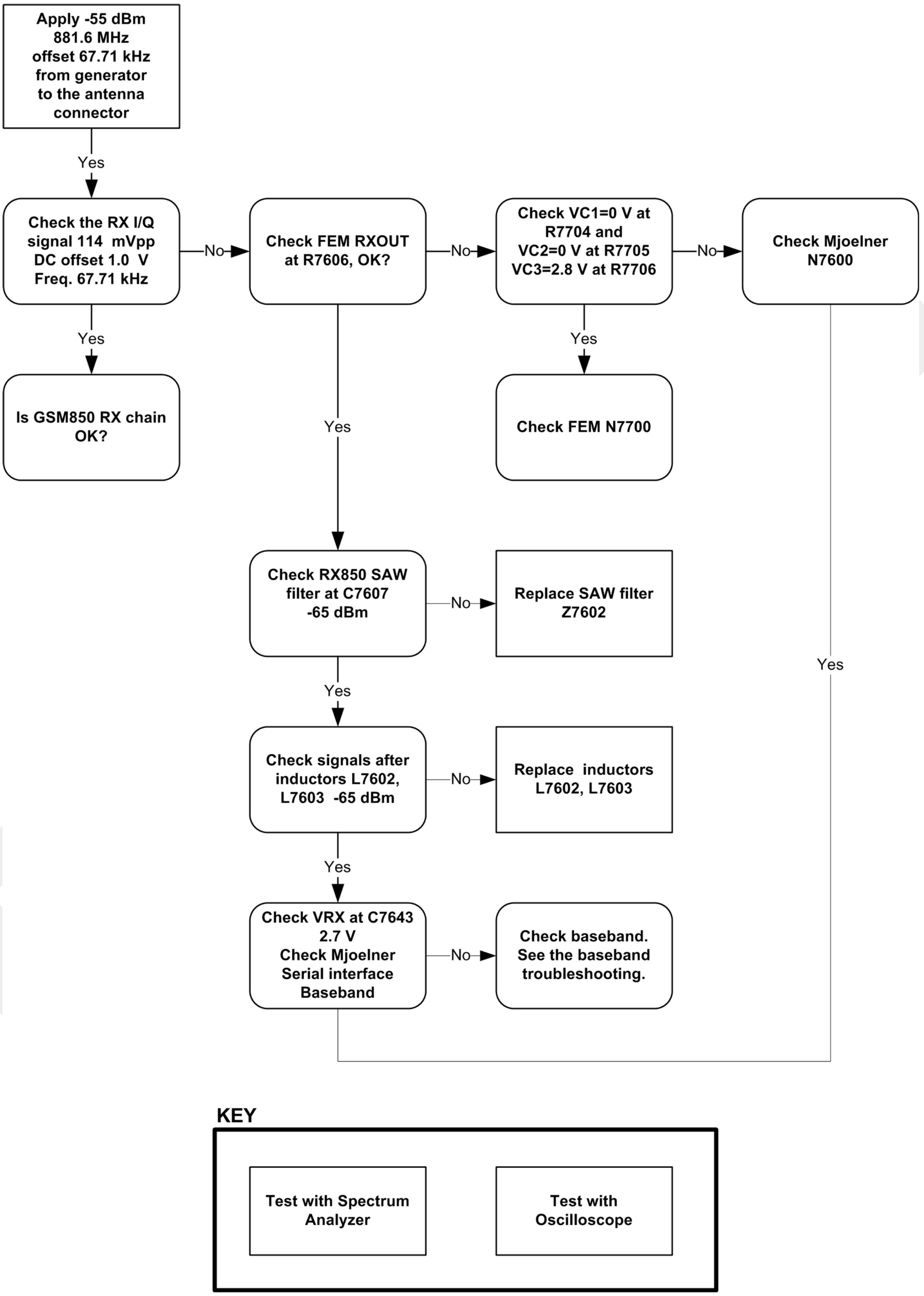

Apply -55 dBm
881.6 MHz
offset 67.71 kHz
from generator
to the antenna
connector
Yes
Check the RX I/Q signal 114 mVpp DC offset 1.0 V Freq. 67.71 kHz
No
Check FEM RXOUT at R7606, OK?
No
Check VC1=0 V at R7704 and VC2=0 V at R7705 VC3=2.8 V at R7706
No
Check Mjoelner N7600
Yes
Is GSM850 RX chain OK?
Yes
Yes
Check FEM N7700
Check RX850 SAW filter at C7607 -65 dBm
No
Replace SAW filter Z7602
Yes
Yes
Check signals after inductors L7602, L7603 -65 dBm
No
Replace inductors L7602, L7603
Yes
Check VRX at C7643 2.7 V Check Mjoelner Serial interface Baseband
No
Check baseband. See the baseband troubleshooting.
KEY
Test with Spectrum Analyzer
Test with Oscilloscope

Figure 56 GSM850 receiver troubleshooting

Results

By measuring with an oscilloscope at RXIP or RXQP on a working GSM850 receiver this picture should be seen. Signal amplitude 114mVp-p. DC offset 1.0V.

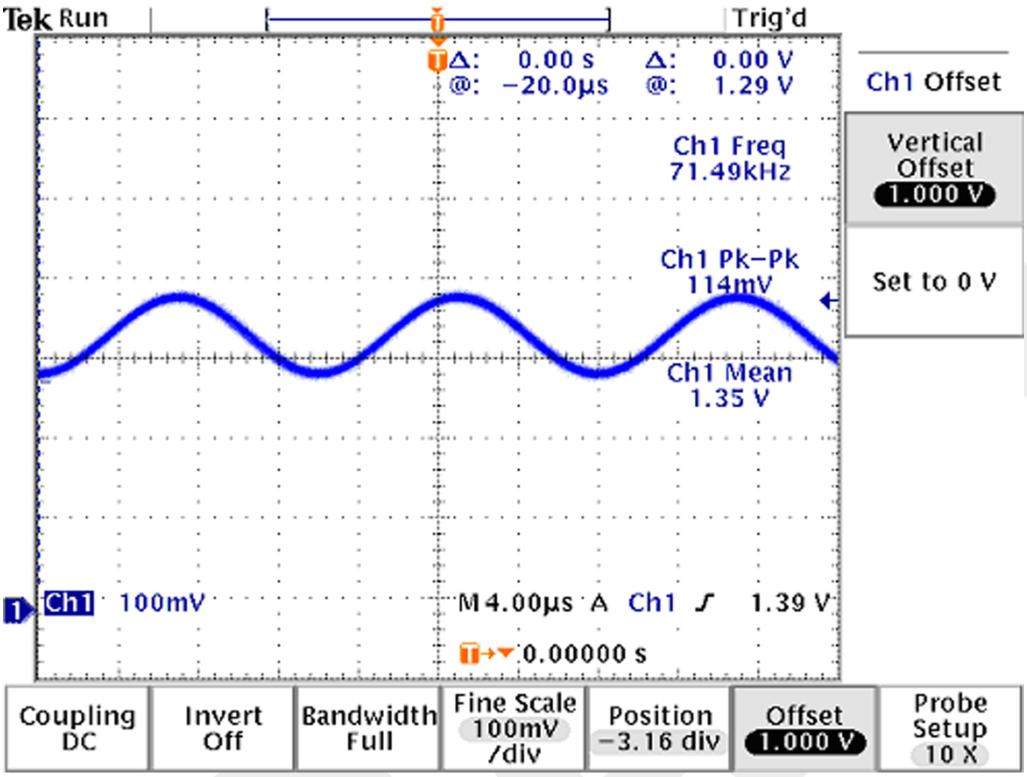


Figure 57 850 RX I/Q signal waveform

General instructions for GSM1900 RX troubleshooting

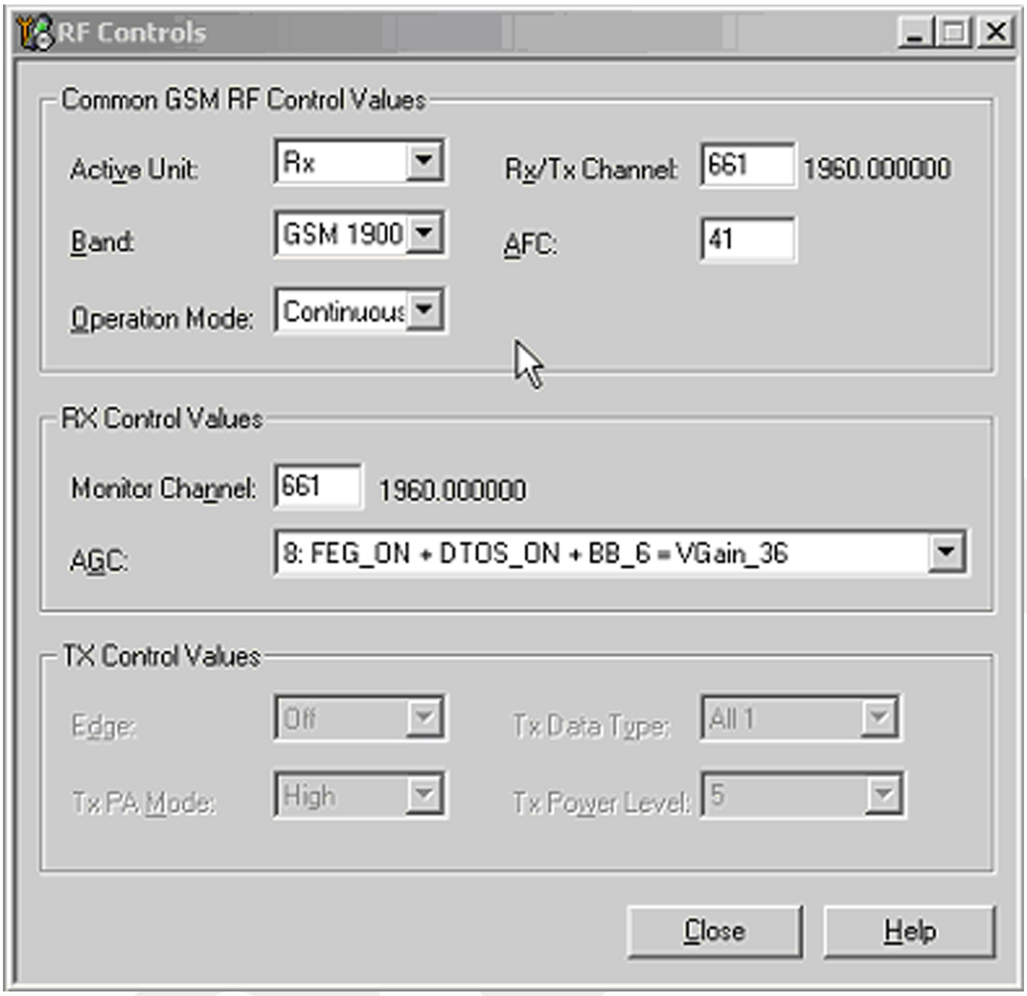
Steps

1. Connect the phone to a PC with the module repair jig.
2. Start Phoenix and establish a connection to the phone with the data cable e.g. FBUS.
3. Select File and Scan product.
4. Wait a while for the PC to read the information from the phone.
5. Select Testing and RF Controls.
6. Set the parameters as follows:
   - i Active Unit: RX
   - ii Band: GSM 1900
   - iii Operation Mode: Continuous mode
   - iv RX/TX Channel 661
   - v AGC: 8: FEG_ON + DTOS_ON+BB_6=Vgain_36

Results

The setup should now look like this:

DRAFT


RF Controls
Common GSM RF Control Values
RX Control Values
TX Control Values
Close
Help

Active Unit: Rx

Band: GSM 1900

Operation Mode: Continuous

Rx/Tx Channel: 661 1960.000000

AFC: 41

Monitor Channel: 661 1960.000000

AGC: 8: FEG_ON + DTOS_ON + BB_6 = VGain_36

Edge: Off

Tx Data Type: All 1

Tx PA Mode: High

Tx Power Level: 5

Figure 58 GSM 1900 RF controls window

DRAFT

Troubleshooting diagram for GSM1900 receiver

Troubleshooting flow

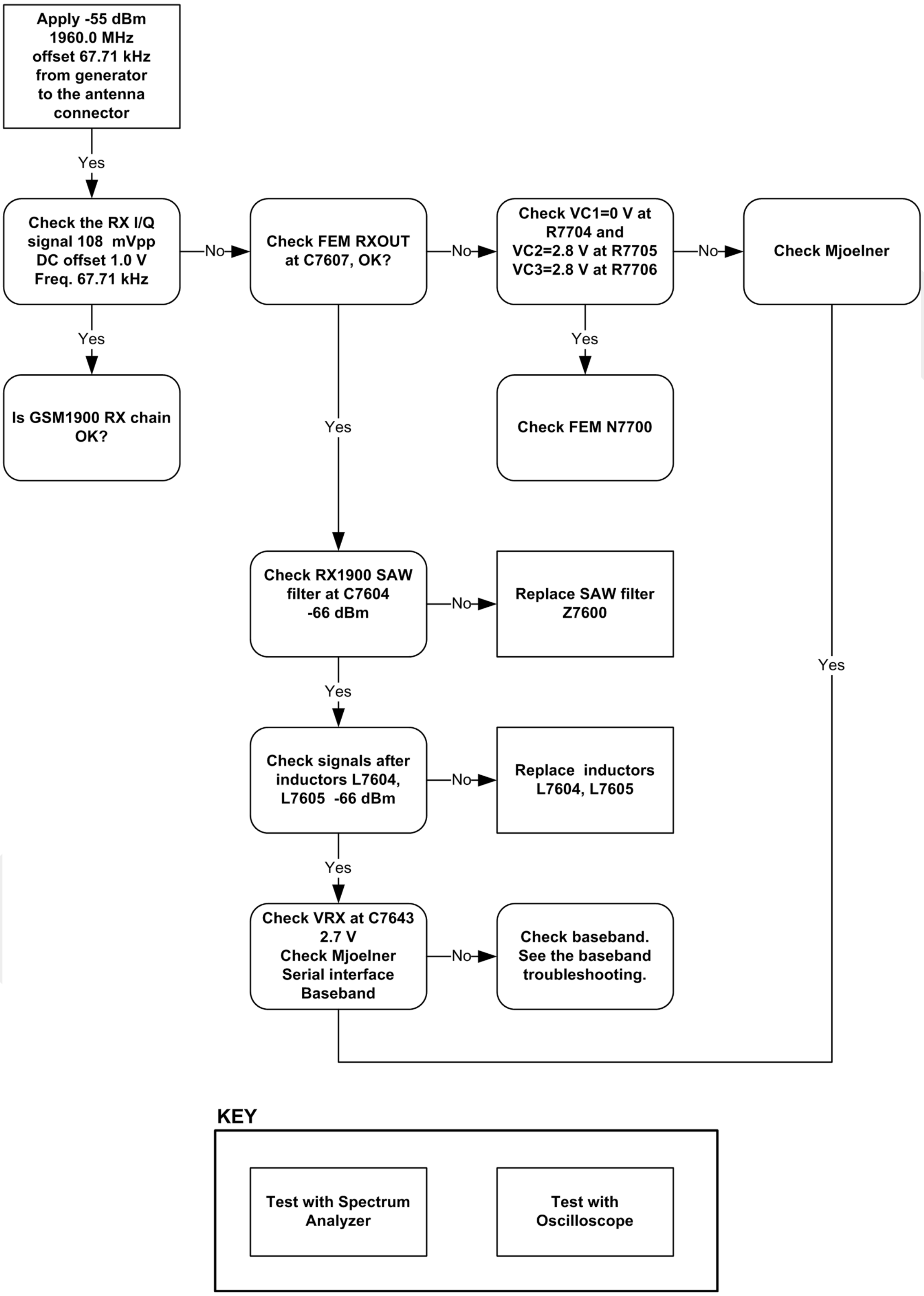

Apply -55 dBm 1960.0 MHz offset 67.71 kHz from generator to the antenna connector
Yes
Check the RX I/Q signal 108 mVpp DC offset 1.0 V Freq. 67.71 kHz
No
Check FEM RXOUT at C7607, OK?
No
Check VC1=0 V at R7704 and VC2=2.8 V at R7705 VC3=2.8 V at R7706
No
Check Mjoelner
Yes
Is GSM1900 RX chain OK?
Yes
Yes
Check FEM N7700
Check RX1900 SAW filter at C7604 -66 dBm
No
Replace SAW filter Z7600
Yes
Yes
Check signals after inductors L7604, L7605 -66 dBm
No
Replace inductors L7604, L7605
Yes
Check VRX at C7643 2.7 V Check Mjoelner Serial interface Baseband
No
Check baseband. See the baseband troubleshooting.
KEY
Test with Spectrum Analyzer
Test with Oscilloscope

Figure 59 GSM1900 receiver troubleshooting

Results

By measuring with an oscilloscope at RXIP or RXQP on a working GSM1900 receiver this picture should be seen. Signal amplitude 108 mVp-p. DC offset 1.0V.

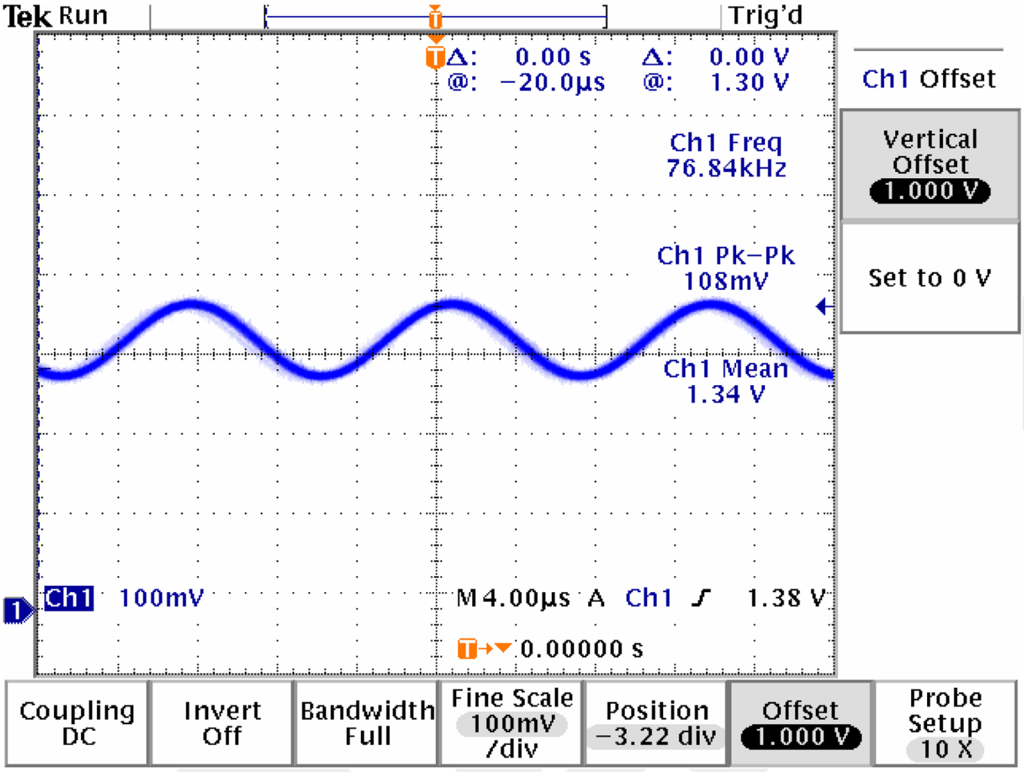

Tek Run
Trig'd
Δ: 0.00 s
@: −20.0µs
Δ: 0.00 V
@: 1.30 V
Ch1 Freq
76.84kHz
Ch1 Pk−Pk
108mV
Ch1 Mean
1.34 V
Ch1 100mV
M 4.00µs A Ch1 ∫ 1.38 V
0.00000 s
Ch1 Offset
Vertical Offset
1.000 V
Set to 0 V
Coupling DC
Invert Off
Bandwidth Full
Fine Scale 100mV /div
Position −3.22 div
Offset 1.000 V
Probe Setup 10 X

Figure 60 1900 RX I/Q signal waveform

Measurement points in the receiver

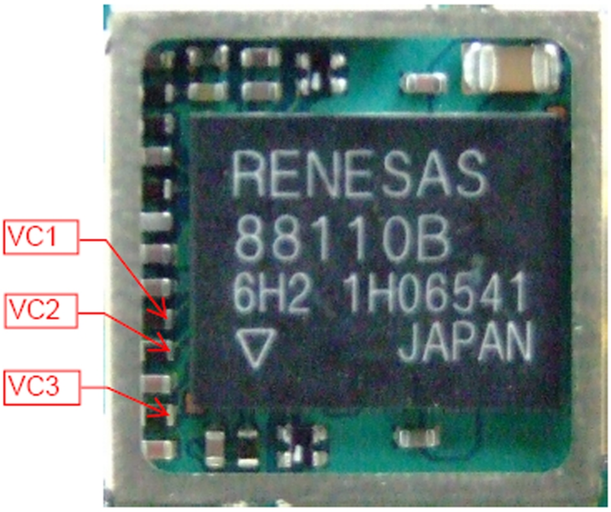

RENESAS
88110B
6H2 1H06541
JAPAN
VC1
VC2
VC3

Figure 61 RX measurements point of the control voltages to FEM N7700

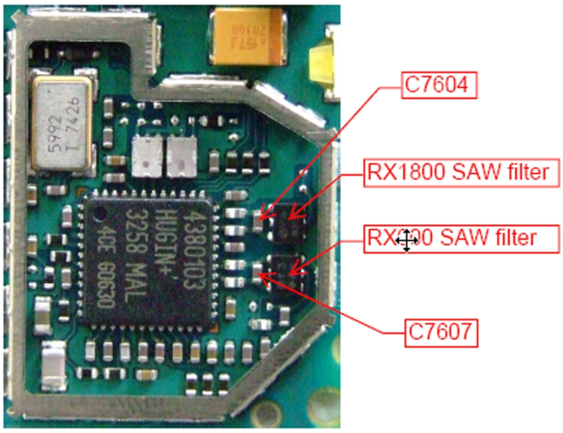


Figure 62 Measurement points at the RX SAW Filters – Z7600/Z7602

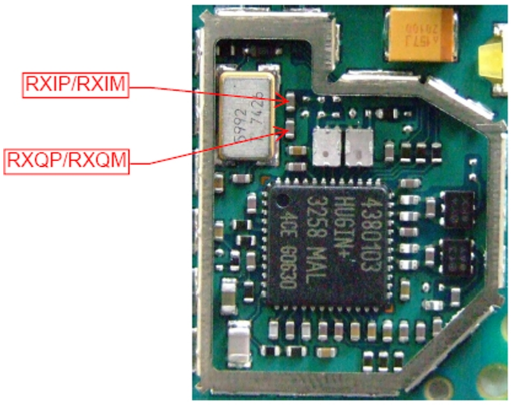


Figure 63 RX I/Q signals

RH-117 transmitter

General instructions for GSM 850 TX troubleshooting

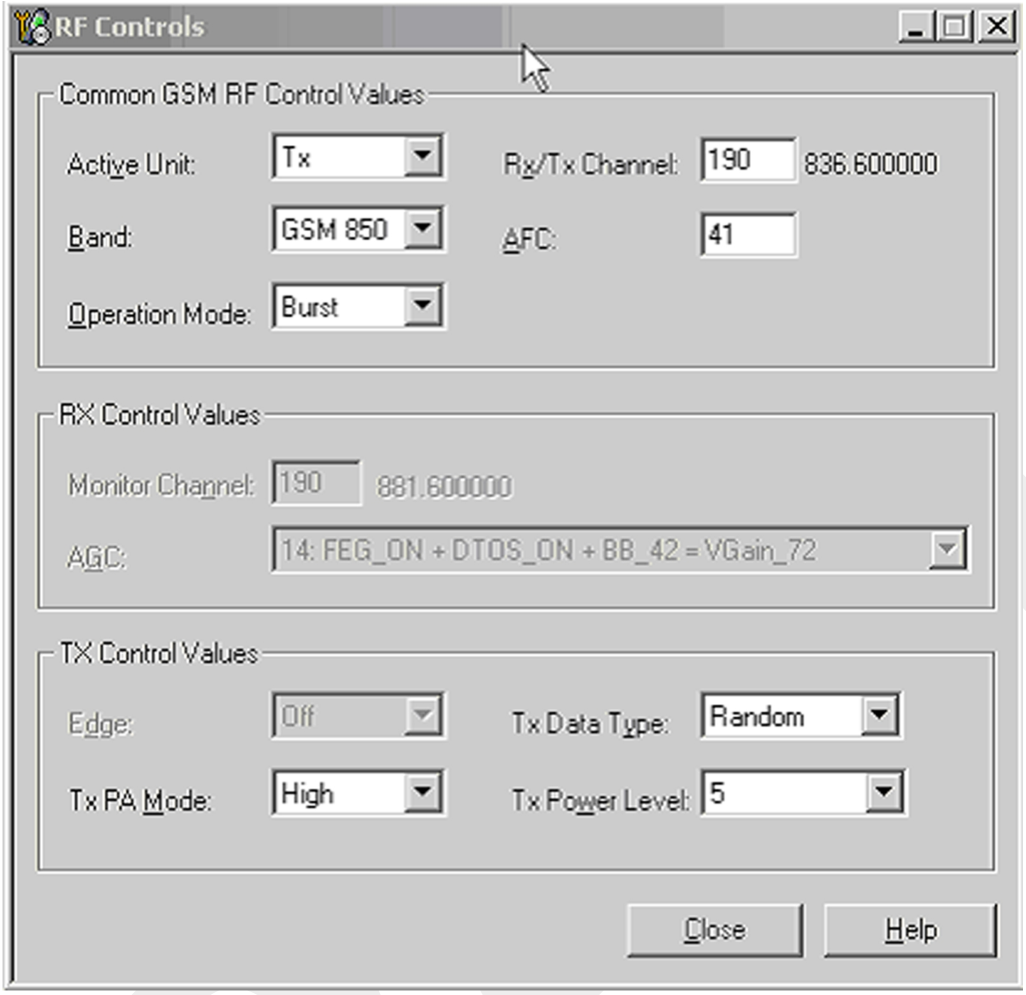
Steps

1. Apply a RF-cable to the RF-connector to allow the transmitted signal act as normal. RF-cable should be connected to an attenuator at least 10dB before connected to the measurement equipment, otherwise the PA may be damaged.
2. Start *Phoenix* and establish a connection to the phone with the data cable e.g. FBUS.
3. Select File and Scan product.
4. Wait a while for the PC to read the information from the phone.
5. Select Testing and RF Controls.
6. Set the parameters as follows:
   - i Band: GSM 850
   - ii Active Unit: TX
   - iii TX Power Level: 5
   - iv TX Data Type: Random

Results

The setup should now look like this:

DRAFT



Common GSM RF Control Values

Active Unit: Tx

Rx/Tx Channel: 190 836.600000

Band: GSM 850

AFC: 41

Operation Mode: Burst

RX Control Values

Monitor Channel: 190 881.600000

AGC: 14: FEG_ON + DTOS_ON + BB_42 = VGain_72

TX Control Values

Edge: Off

Tx Data Type: Random

Tx PA Mode: High

Tx Power Level: 5

Figure 64 GSM 850 RF controls window

DRAFT

Troubleshooting diagram for GSM850 transmitter

Troubleshooting flow

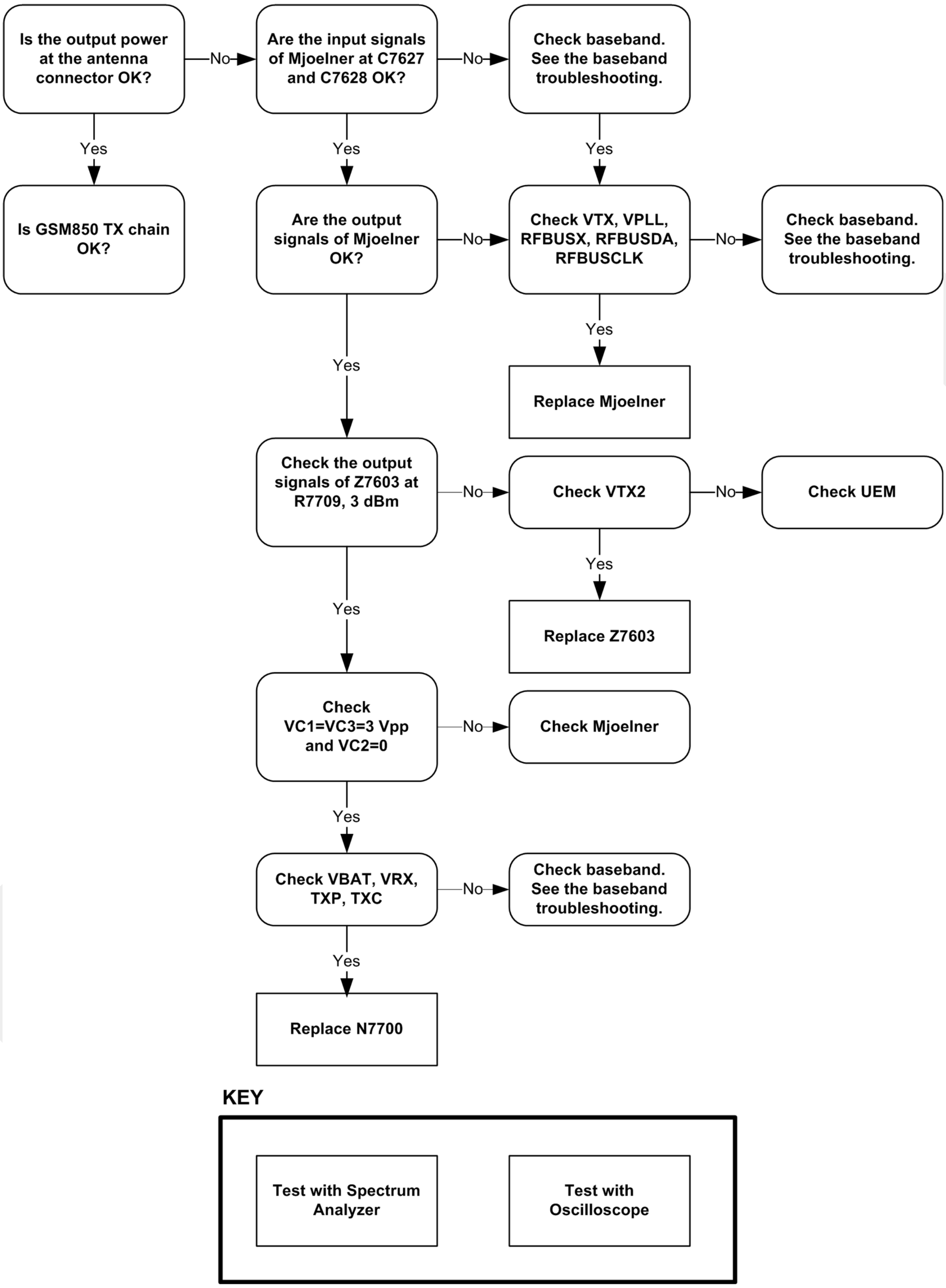
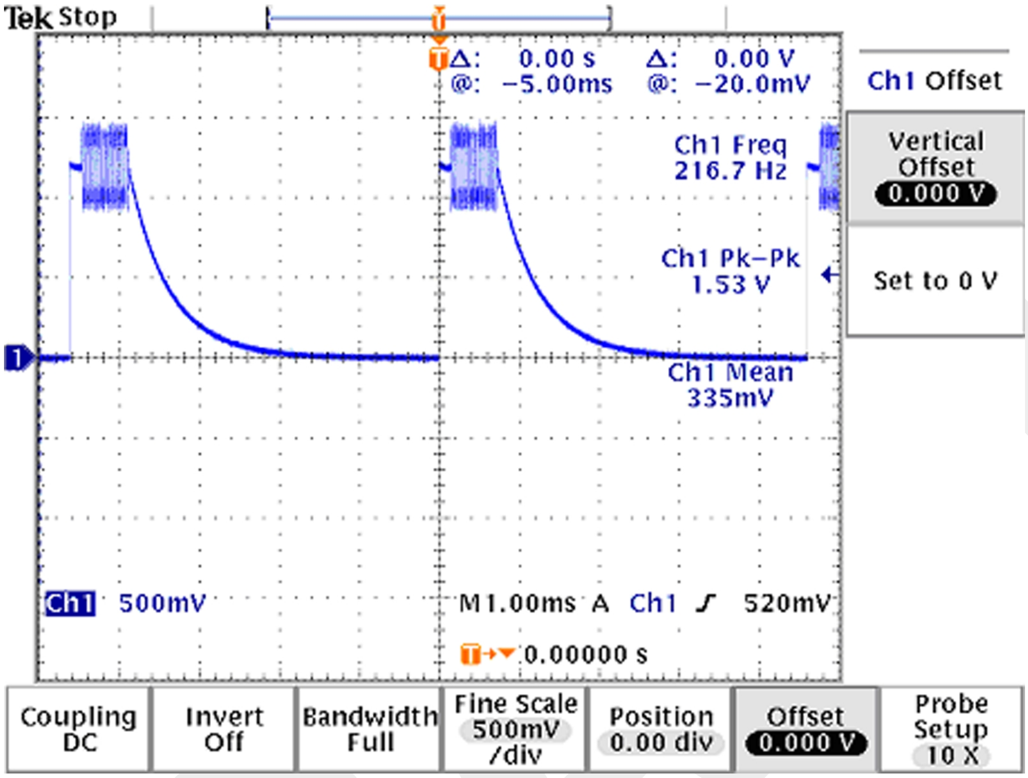

Is the output power at the antenna connector OK?
No
Are the input signals of Mjoelner at C7627 and C7628 OK?
No
Check baseband. See the baseband troubleshooting.
Yes
Is GSM850 TX chain OK?
Yes
Are the output signals of Mjoelner OK?
Yes
No
Check VTX, VPLL, RFBUSX, RFBUSDA, RFBUSCLK
No
Check baseband. See the baseband troubleshooting.
Yes
Replace Mjoelner
Yes
Check the output signals of Z7603 at R7709, 3 dBm
No
Check VTX2
No
Check UEM
Yes
Replace Z7603
Yes
Check VC1=VC3=3 Vpp and VC2=0
No
Check Mjoelner
Yes
Check VBAT, VRX, TXP, TXC
No
Check baseband. See the baseband troubleshooting.
Yes
Replace N7700
KEY
Test with Spectrum Analyzer
Test with Oscilloscope

Figure 65 GSM850 transmitter troubleshooting

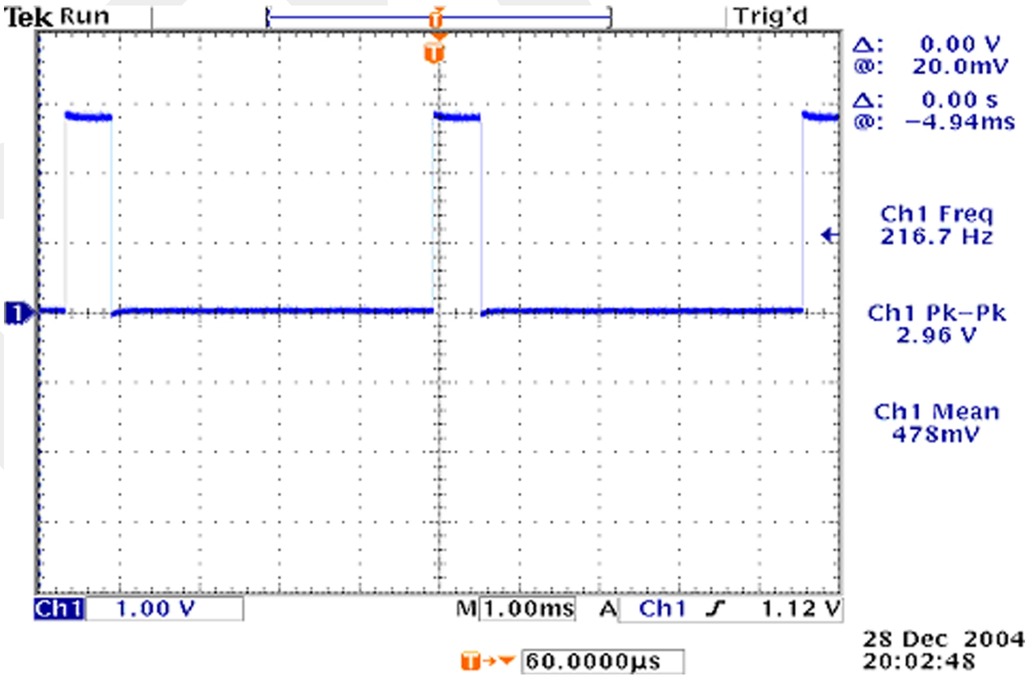
GSM850 TX output power

Measure the output power of the phone; it should be about 32.5 dBm. Remember the cable loss is about 0.3 dB.



Δ: 0.00 s
@: −5.00ms
Δ: 0.00 V
@: −20.0mV
Ch1 Freq 216.7 Hz
Ch1 Pk−Pk 1.53 V
Ch1 Mean 335mV
Ch1 500mV
M 1.00ms A Ch1 ∫ 520mV
0.00000 s
Ch1 Offset
Vertical Offset 0.000 V
Set to 0 V
Coupling DC
Invert Off
Bandwidth Full
Fine Scale 500mV /div
Position 0.00 div
Offset 0.000 V
Probe Setup 10 X

Figure 66 TX I/O signal



Δ: 0.00 V
@: 20.0mV
Δ: 0.00 s
@: −4.94ms
Ch1 Freq 216.7 Hz
Ch1 Pk−Pk 2.96 V
Ch1 Mean 478mV
Ch1 1.00 V
M 1.00ms A Ch1 ∫ 1.12 V
60.0000µs
28 Dec 2004
20:02:48

Figure 67 VC1, VC3 signal

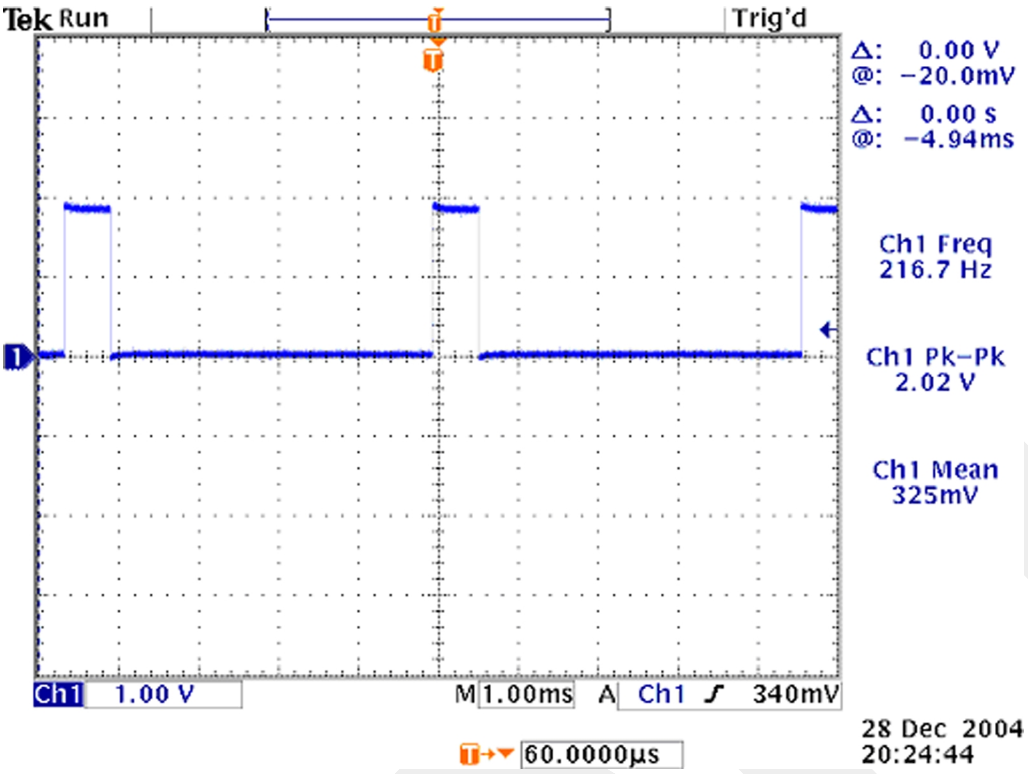

Tek Run
Trig'd
Δ: 0.00 V
@: −20.0mV
Δ: 0.00 s
@: −4.94ms
Ch1 Freq
216.7 Hz
Ch1 Pk−Pk
2.02 V
Ch1 Mean
325mV
Ch1 1.00 V
M 1.00ms A Ch1 ∫ 340mV
60.0000µs
28 Dec 2004
20:24:44

Figure 68 TXP signal

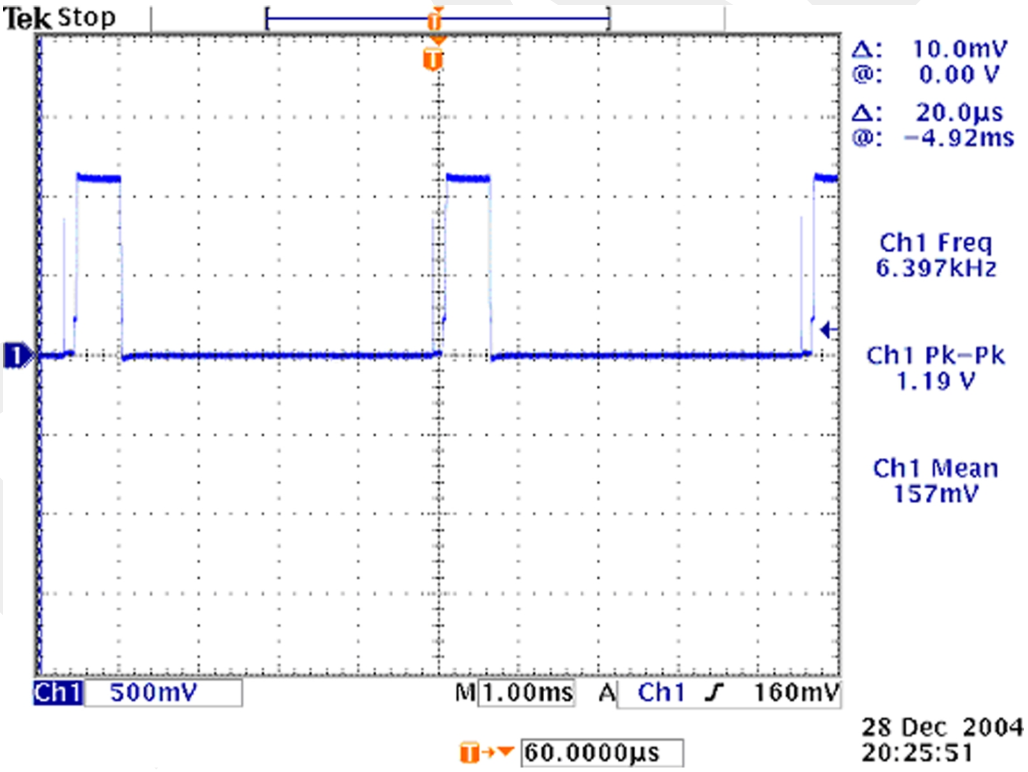

Tek Stop
Δ: 10.0mV
@: 0.00 V
Δ: 20.0µs
@: −4.92ms
Ch1 Freq
6.397kHz
Ch1 Pk−Pk
1.19 V
Ch1 Mean
157mV
Ch1 500mV
M 1.00ms A Ch1 ∫ 160mV
60.0000µs
28 Dec 2004
20:25:51

Figure 69 TXC signals at PCL5

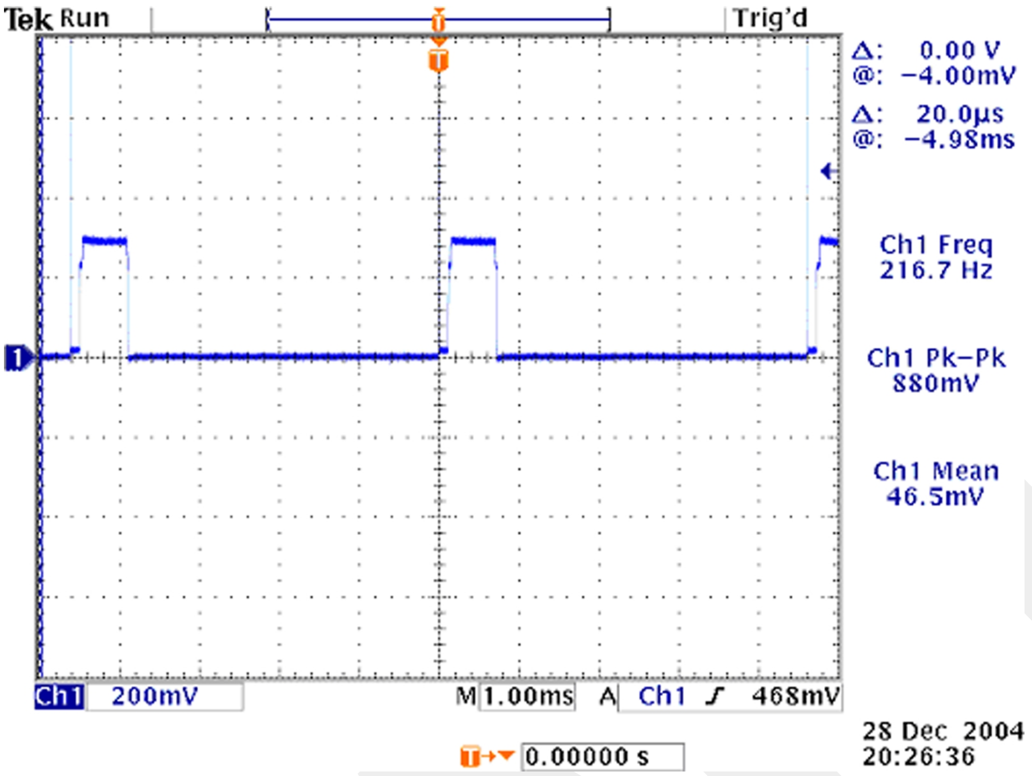

Tek Run
Trig'd
Δ: 0.00 V
@: −4.00mV
Δ: 20.0μs
@: −4.98ms
Ch1 Freq
216.7 Hz
Ch1 Pk−Pk
880mV
Ch1 Mean
46.5mV
Ch1 200mV
M 1.00ms A Ch1 ∫ 468mV
0.00000 s
28 Dec 2004
20:26:36

Figure 70 TXC signals at PCL19

General instructions for GSM1900 TX troubleshooting

Steps

1. Apply a RF-cable to the RF-connector to allow the transmitted signal act as normal. RF-cable should be connected to an attenuator at least 10dB before connected to the measurement equipment, otherwise the PA may be damaged.
2. Start *Phoenix* and establish a connection to the phone with the data cable e.g. FBUS.
3. Select File and Scan product.
4. Wait a while for the PC to read the information from the phone.
5. Select Testing and RF Controls.
6. Set the parameters as follows:
   i Band: GSM 1900
   ii Active Unit: TX
   iii TX Power Level: 0
   iv TX Data Type: Random

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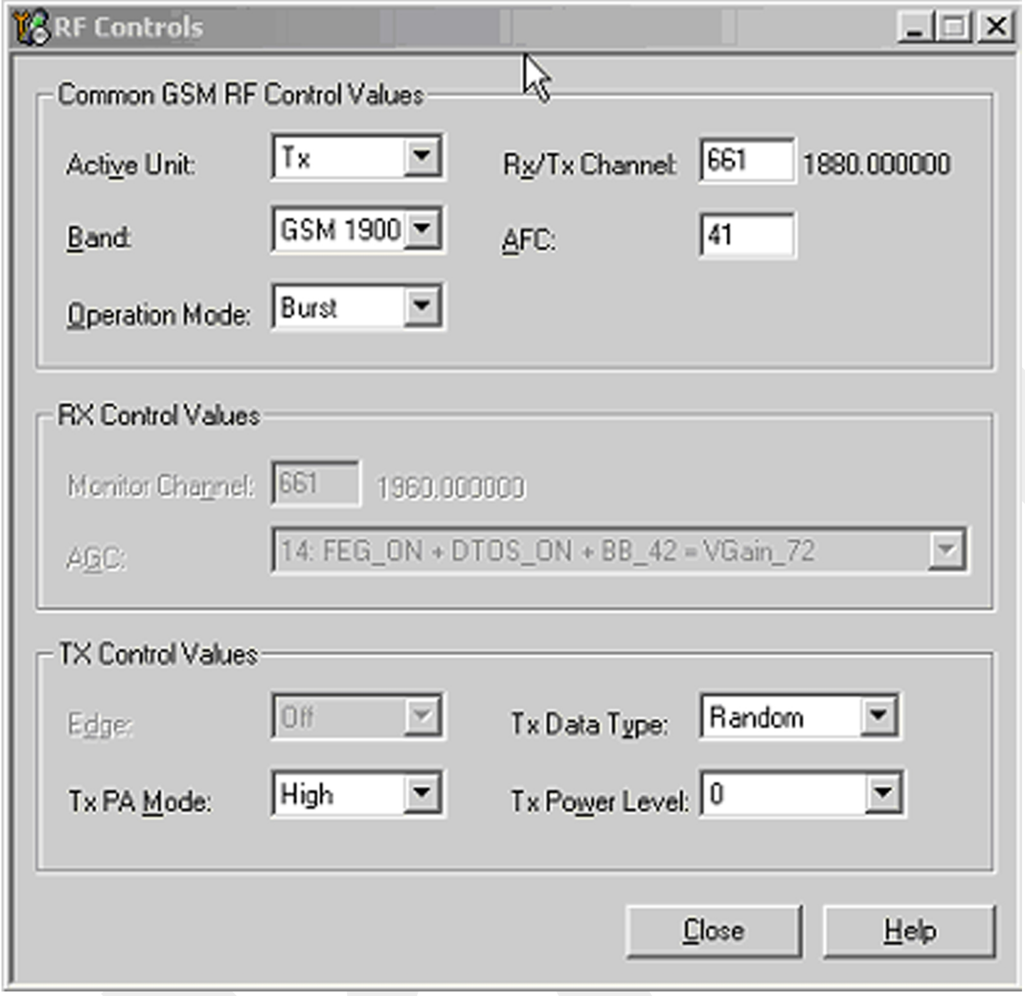
7. The setup should now look like this:


RF Controls
Common GSM RF Control Values
RX Control Values
TX Control Values
Close
Help

Active Unit: Tx
Band: GSM 1900
Operation Mode: Burst
Rx/Tx Channel: 661 1880.000000
AFC: 41
Monitor Channel: 661 1960.000000
AGC: 14: FEG_ON + DTOS_ON + BB_42 = VGain_72
Edge: Off
Tx PA Mode: High
Tx Data Type: Random
Tx Power Level: 0

Figure 71 GSM 1900 RF controls window

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Troubleshooting diagram for GSM1900 transmitter

Troubleshooting flow

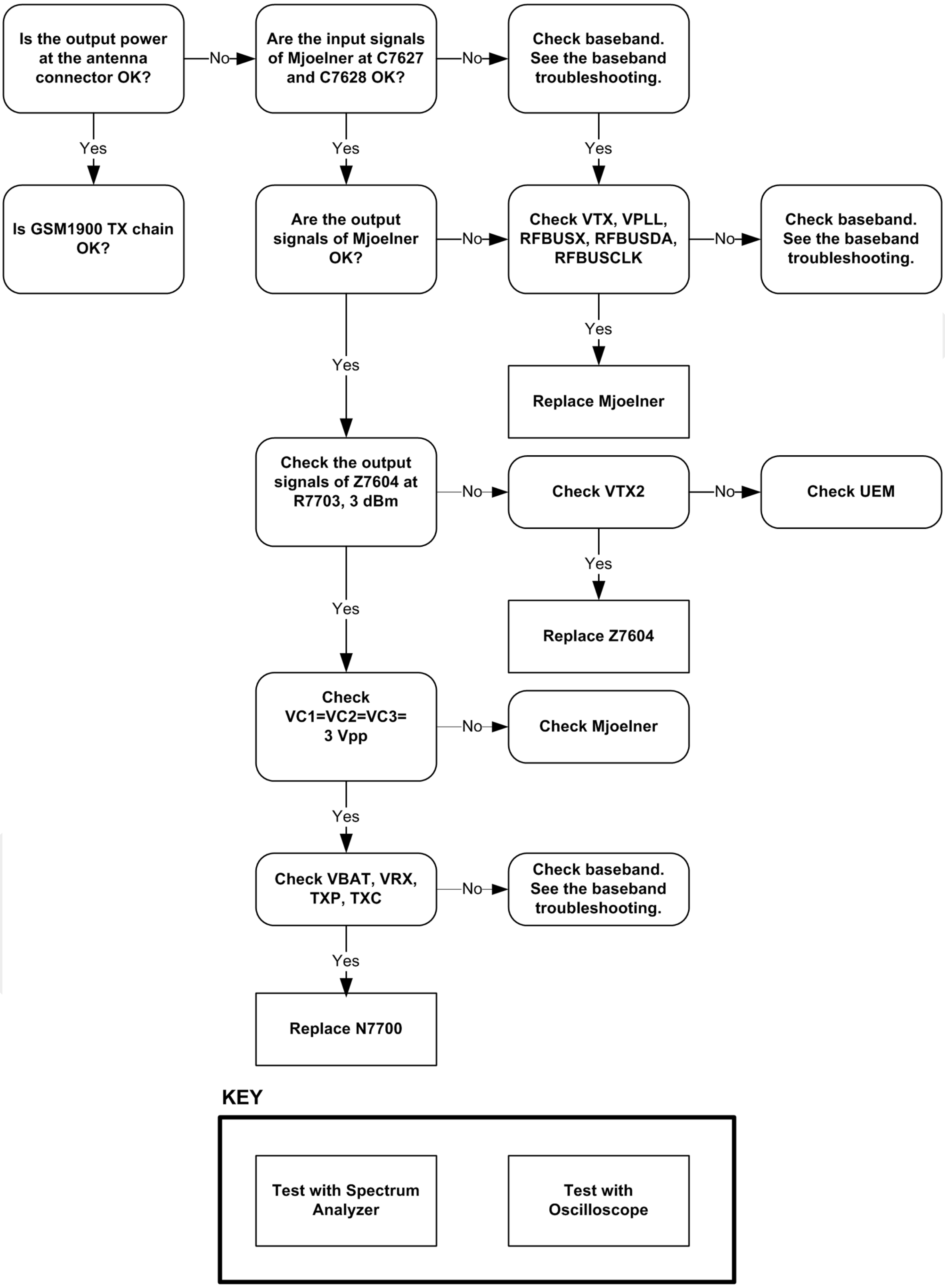
Is the output power at the antenna connector OK?
No
Are the input signals of Mjoelner at C7627 and C7628 OK?
No
Check baseband. See the baseband troubleshooting.
Yes
Is GSM1900 TX chain OK?
Yes
Are the output signals of Mjoelner OK?
No
Yes
Check VTX, VPLL, RFBUSX, RFBUSDA, RFBUSCLK
No
Check baseband. See the baseband troubleshooting.
Yes
Replace Mjoelner
Yes
Check the output signals of Z7604 at R7703, 3 dBm
No
Check VTX2
No
Check UEM
Yes
Replace Z7604
Yes
Check VC1=VC2=VC3= 3 Vpp
No
Check Mjoelner
Yes
Check VBAT, VRX, TXP, TXC
No
Check baseband. See the baseband troubleshooting.
Yes
Replace N7700
KEY
Test with Spectrum Analyzer
Test with Oscilloscope

Figure 72 GSM1900 transmitter troubleshooting

GSM1900 TX output power

Measure the output power of the phone; it should be about 29.5 dBm. Remember the cable loss is about 0.5 dB.

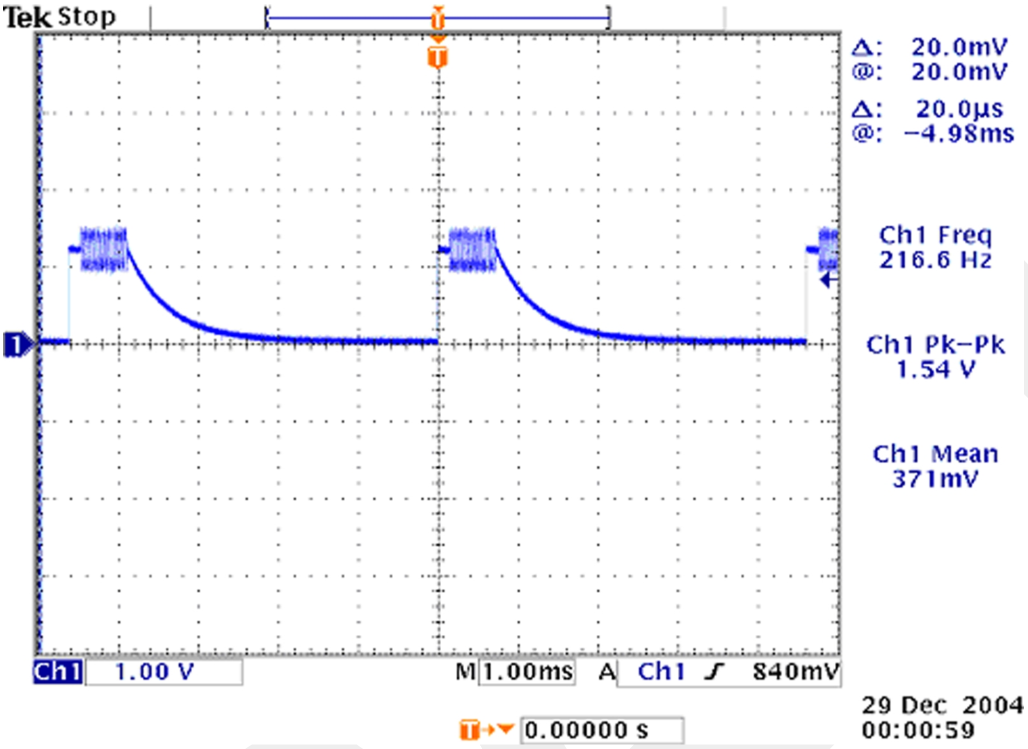

Figure 73 TX I/O signal

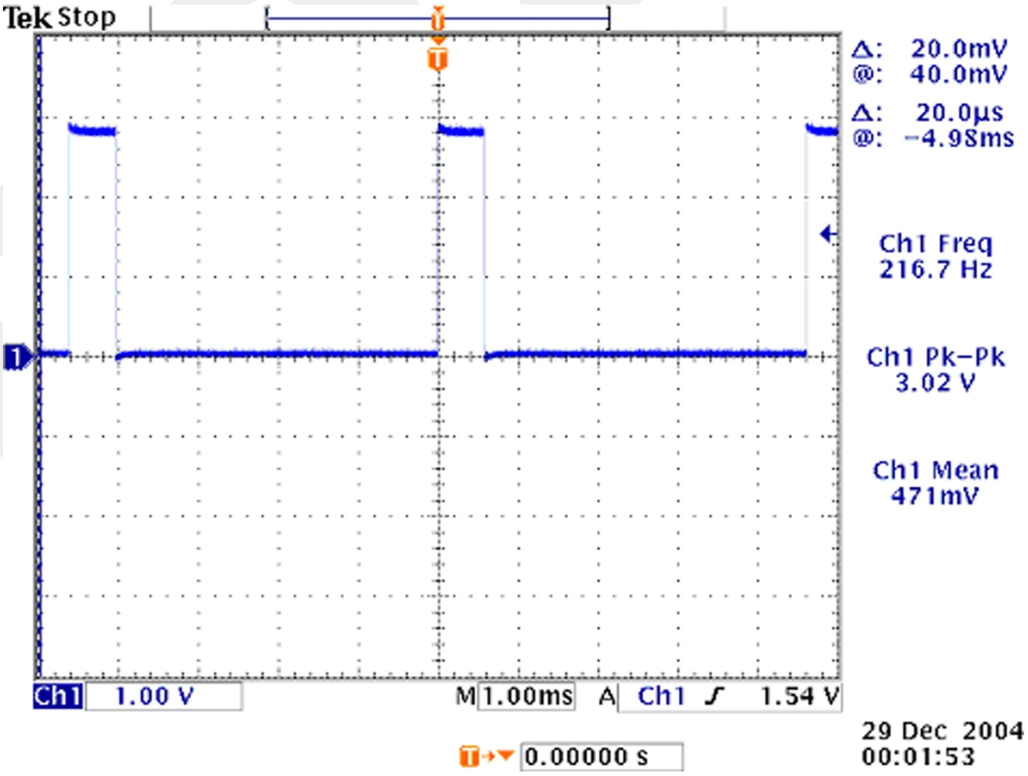

Figure 74 VC1, VC2, VC3 signals

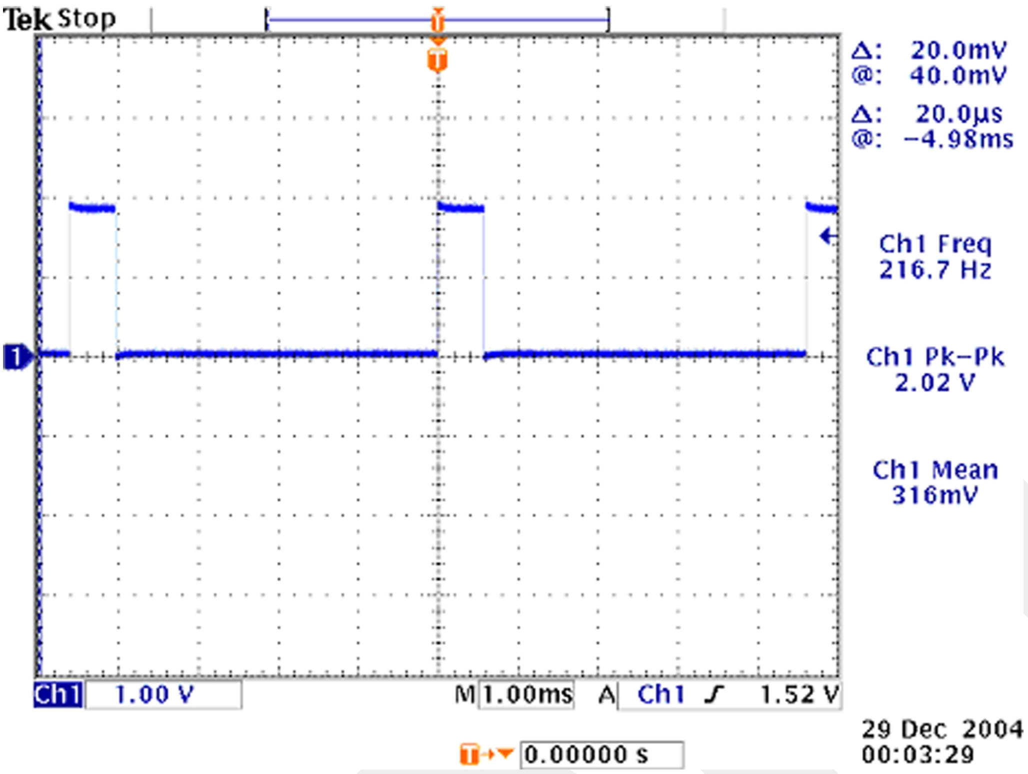
Tek Stop
Δ: 20.0mV
@: 40.0mV
Δ: 20.0µs
@: −4.98ms
Ch1 Freq
216.7 Hz
Ch1 Pk−Pk
2.02 V
Ch1 Mean
316mV
Ch1 1.00 V
M 1.00ms A Ch1 ∫ 1.52 V
0.00000 s
29 Dec 2004
00:03:29

Figure 75 TXP signal

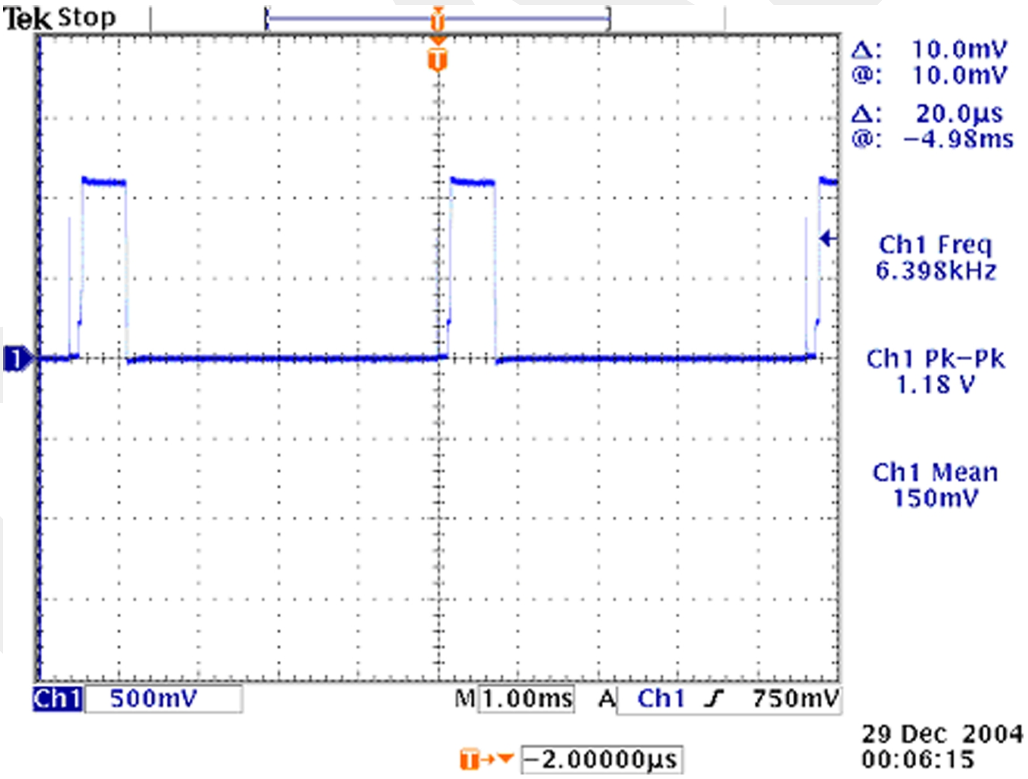
Tek Stop
Δ: 10.0mV
@: 10.0mV
Δ: 20.0µs
@: −4.98ms
Ch1 Freq
6.398kHz
Ch1 Pk−Pk
1.18 V
Ch1 Mean
150mV
Ch1 500mV
M 1.00ms A Ch1 ∫ 750mV
−2.00000µs
29 Dec 2004
00:06:15

Figure 76 TXC signals at PCL0

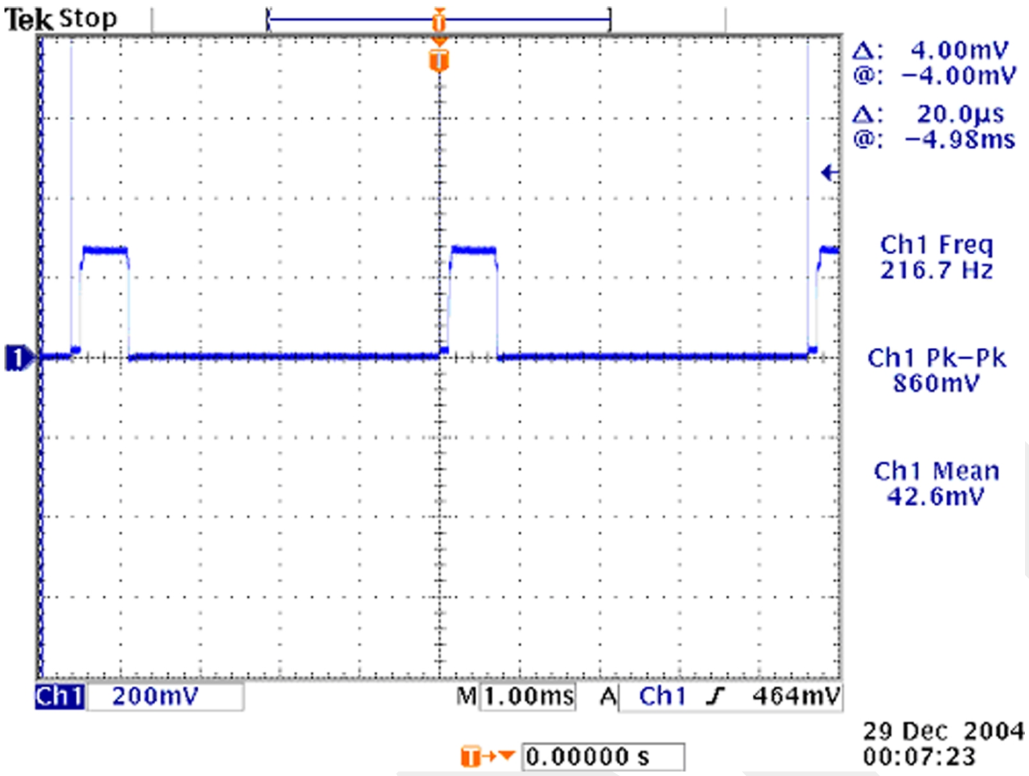

Figure 77 TXC signals at PCL15

Synthesizer troubleshooting

Introduction

26 MHz Reference Oscillator (VCXO)

There is only one PLL synthesizer generating Local Oscillator frequencies for both RX and TX in both bands (PCN and EGSM). The VCO frequency is divided by 2 for PCN operation or by 4 for EGSM operation inside the Mjoelner IC.

The 26MHz oscillator is located near the Mjoelner IC. (N7600). The coarse frequency for this oscillator is set by an external crystal (B7600). The reference oscillator is used as a reference frequency for the PLL synthesizer and as the system clock for the Baseband. The 26MHz signal is divided by 2 to achieve 13MHz inside the UPP IC (D2800).

The 26MHz signal from the VCXO can be measured by probing R2900. The level at this point is approx. 770mVpp. Frequency of this oscillator is adjusted by changing the AFC-register inside the UEM IC. Example Signal Measured at VCXO output (R2900).

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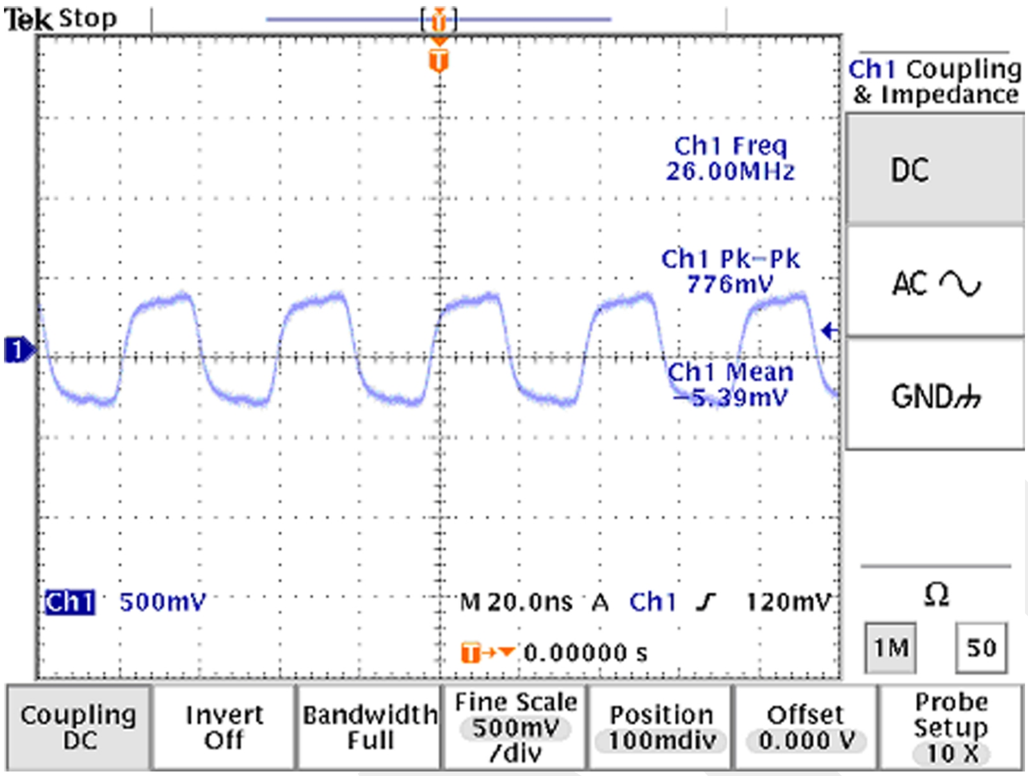
Tek Stop
Ch1 Coupling & Impedance
DC
AC
GND
Ω
1M
50
Coupling DC
Invert Off
Bandwidth Full
Fine Scale 500mV /div
Position 100mdiv
Offset 0.000 V
Probe Setup 10 X

Ch1 Freq 26.00MHz
Ch1 Pk−Pk 776mV
Ch1 Mean −5.39mV
Ch1 500mV
M 20.0ns A Ch1 ∫ 120mV
0.00000 s

Figure 78 VCXO 26 MHz waveform

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Troubleshooting diagram for PLL synthesizer

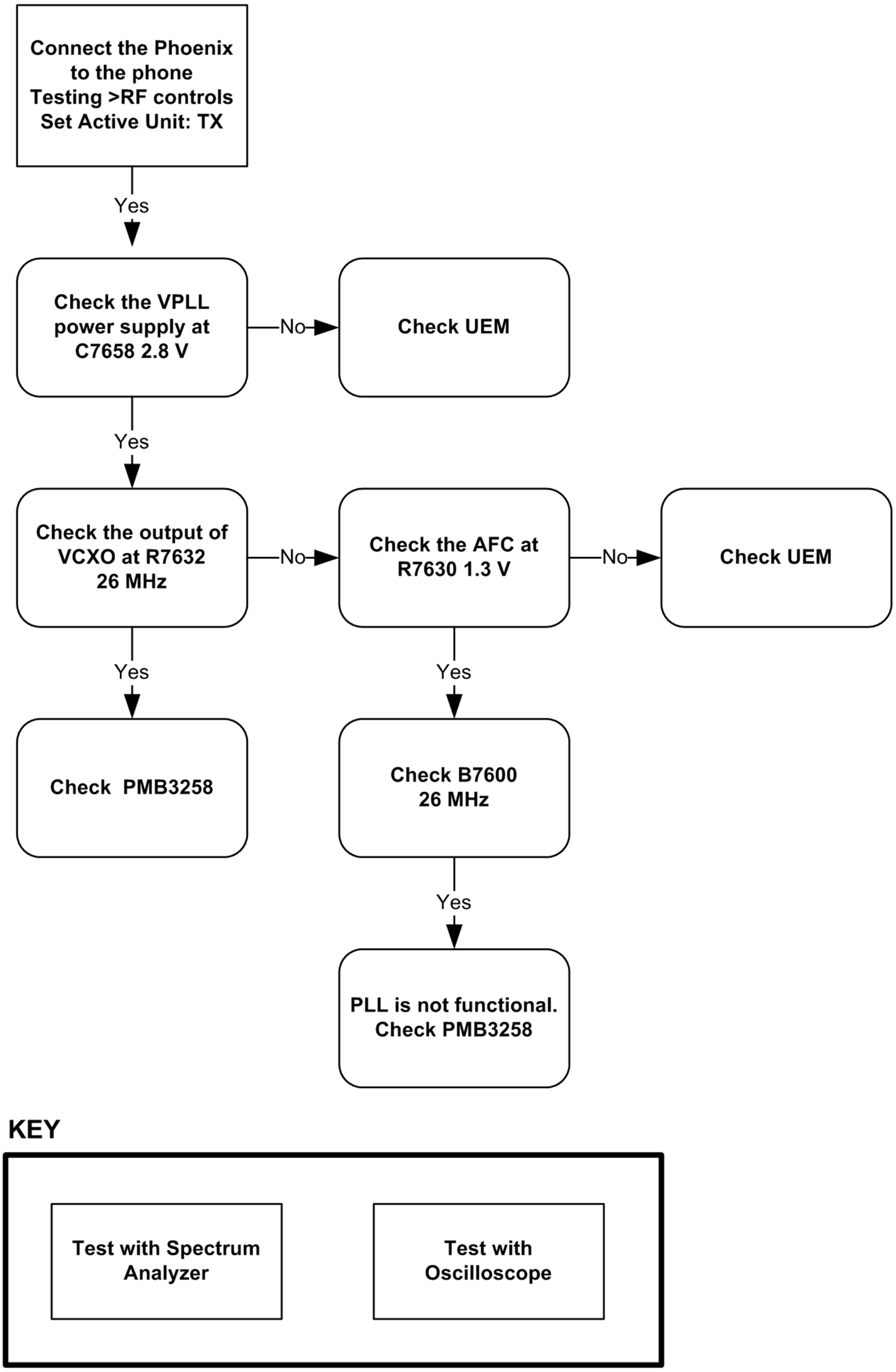
Connect the Phoenix to the phone Testing >RF controls Set Active Unit: TX
Yes
Check the VPLL power supply at C7658 2.8 V
No
Check UEM
Yes
Check the output of VCXO at R7632 26 MHz
No
Check the AFC at R7630 1.3 V
No
Check UEM
Yes
Check PMB3258
Yes
Check B7600 26 MHz
Yes
PLL is not functional. Check PMB3258
KEY
Test with Spectrum Analyzer
Test with Oscilloscope

Figure 79 PLL Troubleshooting diagram

Measurement points at the VCXO

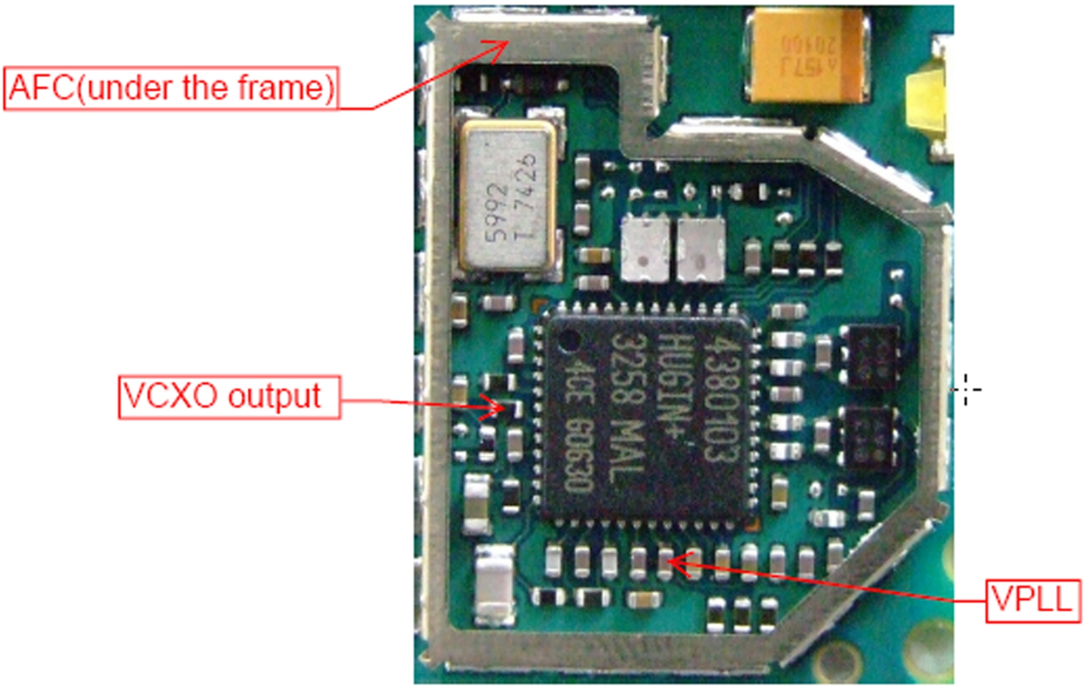
AFC(under the frame)
VCXO output
VPLL
5992
T 7426
4380103
HUGIN+
3258 MAL
4CE G0630

Figure 80 Measurement point for VCXO

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Antenna troubleshooting

Antenna troubleshooting diagram

Troubleshooting flow

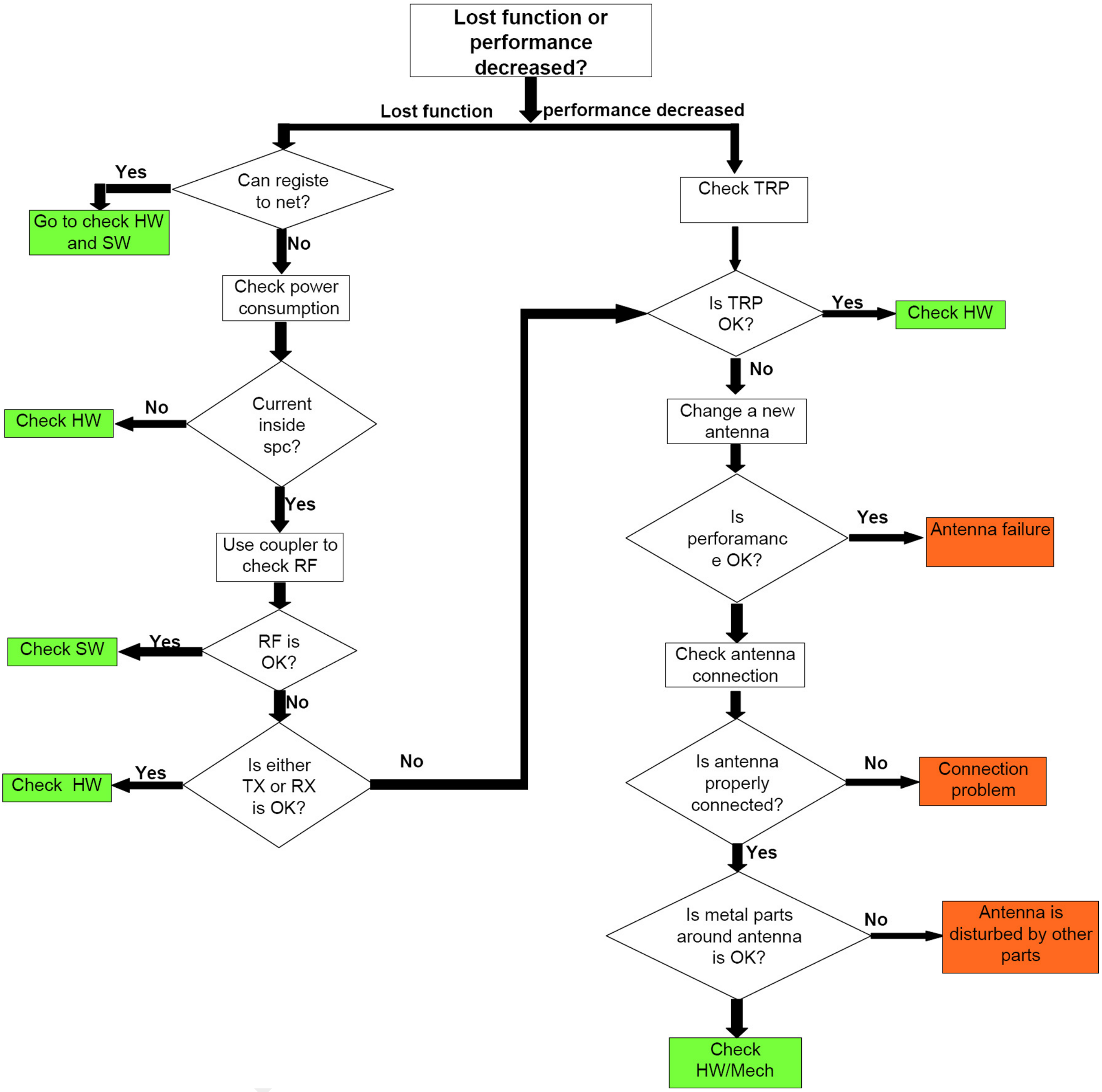
Lost function or performance decreased?
Lost function
performance decreased
Can registe to net?
Yes
Go to check HW and SW
No
Check power consumption
Current inside spc?
No
Check HW
Yes
Use coupler to check RF
RF is OK?
Yes
Check SW
No
Is either TX or RX is OK?
Yes
Check HW
No
Check TRP
Is TRP OK?
Yes
Check HW
No
Change a new antenna
Is perforamanc e OK?
Yes
Antenna failure
Check antenna connection
Is antenna properly connected?
No
Connection problem
Yes
Is metal parts around antenna is OK?
No
Antenna is disturbed by other parts
Check HW/Mech

Figure 81 Antenna troubleshooting

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5 — System Module

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System module block diagram

The main board consists of a radio frequency part and a baseband part. The User Interface parts are situated at the UI side, which is on the opposite side of the engine board. The 2CP is the engine module of the mobile device, and the 2CQ is the UI module of module of the mobile device.

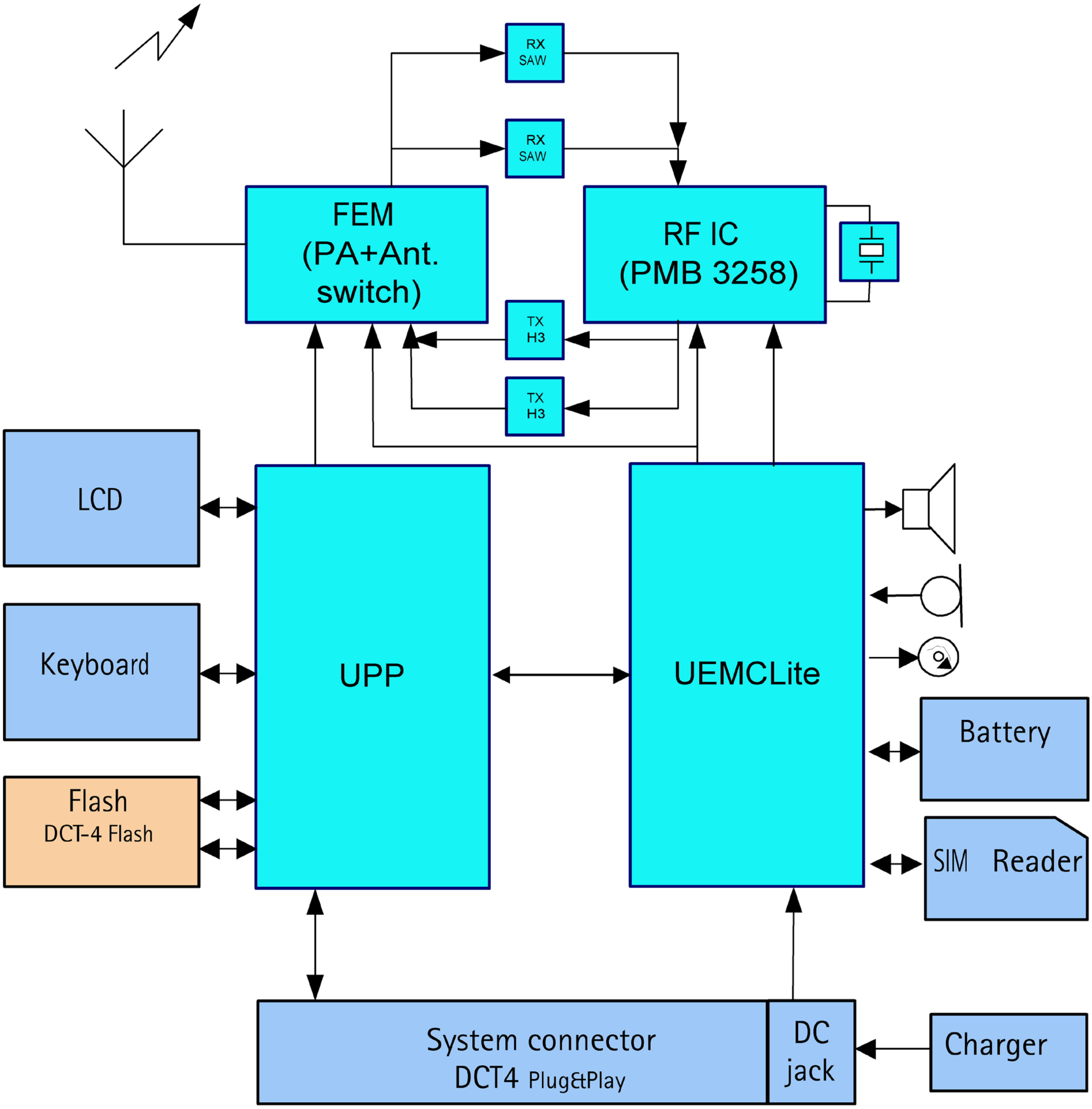
RX SAW
RX SAW
FEM (PA+Ant. switch)
RF IC (PMB 3258)
TX H3
TX H3
LCD
Keyboard
Flash DCT-4 Flash
UPP
UEMCLite
Battery
SIM Reader
System connector DCT4 Plug&Play
DC jack
Charger

Figure 82 Module block diagram

Baseband description

Functional description

The BB core is based on UPP8M CPU. UPP8M takes care of all the signal processing and operation controlling tasks of the mobile device. For power management, there is one main ASIC for controlling charging and supplying power UEMCLite plus a discrete power supply. The main reset for the system is generated by the UEMCLite. The memory comprises of 128 Mbit flash and 16 Mbit PsRAM. memory devices that are stacked on top of each other in a single Combo package.

The interface to the RF and audio sections is also handled by the UEMCLite. This ASIC provides A/D and D/A conversion of the in-phase and quadrature receive and transmit signal paths and also A/D and D/A conversions of received and transmitted audio signals. Data transmission between UEMCLite and RF and the UPP8M is implemented using different serial connections (CBUS, DBUS and RFBUS). Digital speech processing is handled by UPP8M ASIC.

A real time clock function is integrated into UEMCLite, which utilizes the same 32 kHz-clock source as the sleep clock. The SLCK/RTC runs all time when the phone battery is connected. It is running also when the phone is switched off. In UEMCLite there is no back up battery/capacitor connection.

There are three audio transducers in the product; 16 mm speaker, an earpiece and a microphone. The earpiece is used to generate audios for earpiece; the speaker is used to generate audios for IHF and ringing tones. A separate audio amplifier drives the speaker. There is only one microphone for both HS and IHF modes.

The display is an TFT type color display with 65536 colors and 128 x 160 pixels with backlighting. The keypad module features a function keymat with a 4-way navigation key with a center selection key.

UPP

UPP (Universal Phone Processor) is the digital ASIC of the DCT4 generation base band. UPP8M includes 4.5 MBit internal RAM, 16/32-bit RISC MCU core. UPP8Mv6.11 includes ARM7TDMI rev4 16/32-bit RISC MCU core, TI Lead3 16-bit DSP phase2+ core with DMA controller, ROM for MCU boot code and all digital control logic.

Memory

This mobile uses two kinds of memories, Flash and Synchronous RAM (SRAM). These memories have are sharing the same bus interface to UPP8M. SDRAM is used as the working memory. The SRAM size is 16 Mbits.

SRAM I/O is 1.8 V and core 1.8 V supplied by UEMCLite regulator VIO. All memory contents are lost if the supply voltage is switched off.

Multiplexed flash memory interface is used to store the MCU program code and user data.

Configuration of flash memory is a 128 Mbit NOR flash memory. Flash I/O and core voltage are 1.8 V.

UEMCLite

The UEMCLite is a low cost energy management ASIC contains for BB use two 2.78V LDO regulators, 1.8V linear regulator, programmable 1.0 - 1.5 V linear regulator and 1.8/3.0 V LDO regulator. For RF use UEMCLite has five 2.78 V LDOs. In addition, the UEMCLite contains audio codec, A/D converters, RF converters, many drivers, etc.

External regulators

White LED Driver solution is implemented with DC/DC converter. The driver circuit is controlled by UEM output pin DLIGHT, which add external pull up using a digital transistor and one resistor. The schematics also combined the UEMIO (5) to control DC/DC enable as another optional using two jumper.

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Energy management

Filter components

The master of EM control is UEMCLite and with SW it has the main control of the system voltages and operating modes. The power distribution diagram is presented in the illustration below.

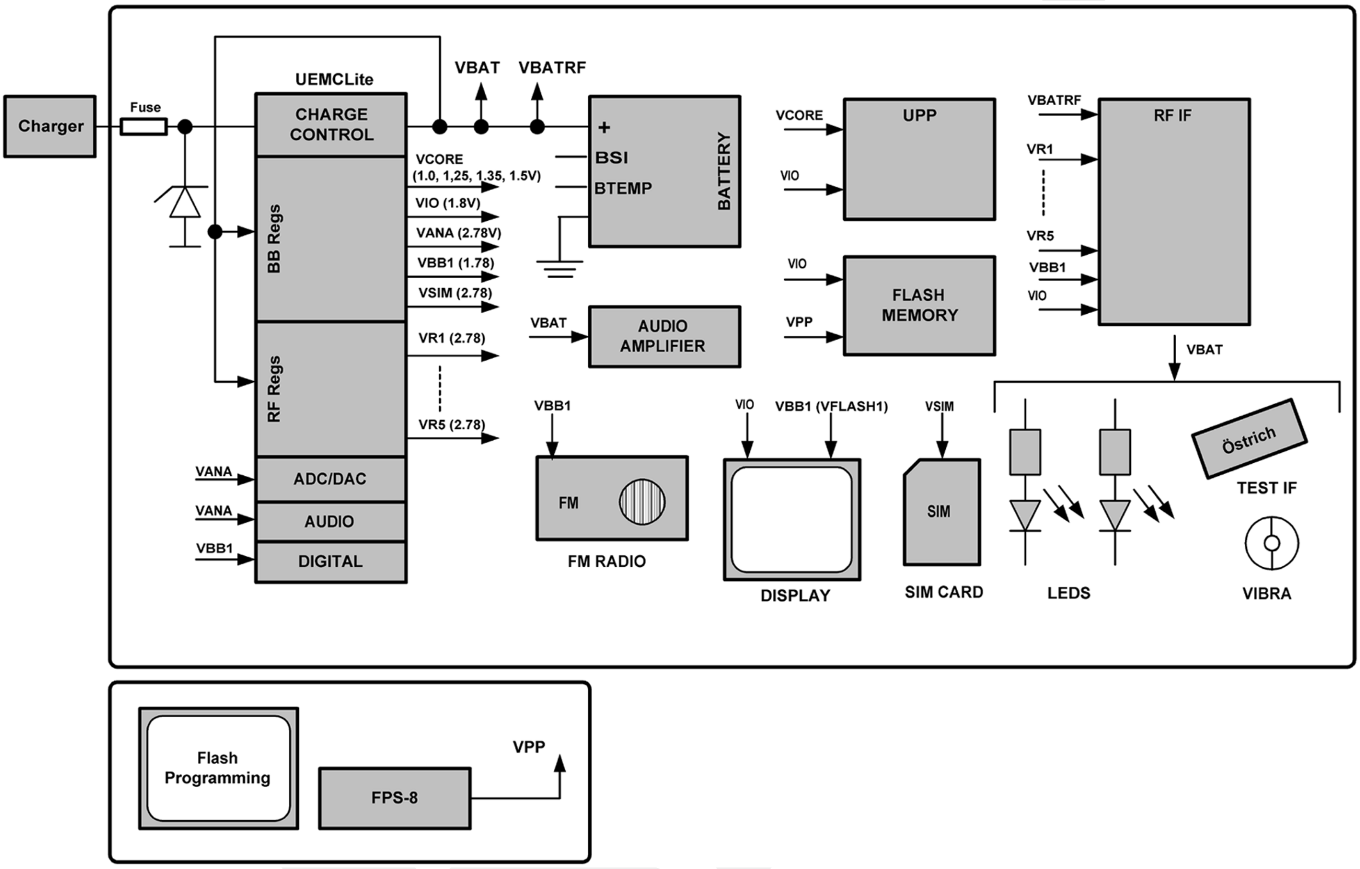
Charger
Fuse
UEMCLite
CHARGE CONTROL
BB Regs
RF Regs
ADC/DAC
AUDIO
DIGITAL
VANA
VANA
VBB1
VBAT
VBATRF
VCORE (1.0, 1,25, 1,35, 1.5V)
VIO (1.8V)
VANA (2.78V)
VBB1 (1.78)
VSIM (2.78)
VR1 (2.78)
VR5 (2.78)
+
BSI
BTEMP
BATTERY
VBAT
AUDIO AMPLIFIER
VBB1
FM
FM RADIO
VCORE
VIO
UPP
VIO
VPP
FLASH MEMORY
VIO
VBB1 (VFLASH1)
DISPLAY
VSIM
SIM
SIM CARD
VBATRF
VR1
VR5
VBB1
VIO
RF IF
VBAT
LEDS
Östrich
TEST IF
VIBRA
Flash Programming
FPS-8
VPP

Figure 83 Power connection diagram

All connectors going to the “outside world” have filter components, ESD protection and EMC reduction. The Digital/Data lines on SIM have special dedicated filter ASIP. The below figure show the SIM filtering.

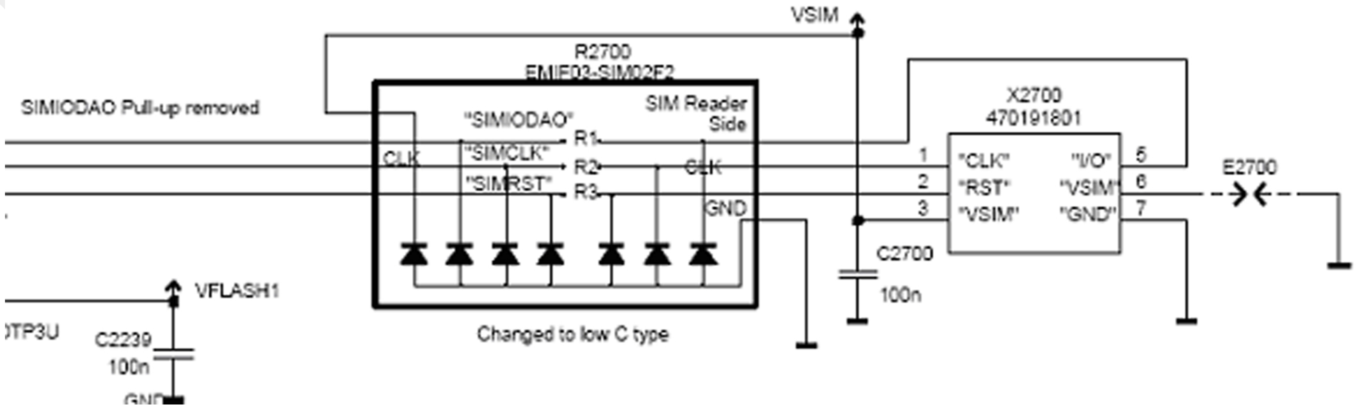
VSIM
R2700
EMIF03-SIM02F2
SIMIODAO Pull-up removed
"SIMIODAO"
"SIMCLK"
"SIMRST"
R1
R2
R3
SIM Reader Side
CLK
CLK
GND
Changed to low C type
X2700
470191801
1
2
3
"CLK"
"RST"
"VSIM"
"I/O"
"VSIM"
"GND"
5
6
7
E2700
C2700
100n
VFLASH1
C2239
100n
GND

Figure 84 SIM filtering

The Audio circuit: Earpiece, IHF, internal microphone and external speaker are filtered with discrete components (common mode reduction coils, Varistors, caps and resistors), where as the external microphone uses differential mode mic. ASIP

The 16 UEMECLite BB & RF regulators are specified to have a decoupling cap of 1 µF ±20%.

Modes of operation

BB4.0 LiteV2 base band has five different functional modes, which are defined in UEMCLite specification:

- No supply: In NO_SUPPLY mode, the phone has no supply voltage. This mode is due to disconnection of main battery or low battery voltage level in battery. Phone is exiting from NO_SUPPLY mode when sufficient battery voltage level is detected. Battery voltage can rise either by connecting a new battery with VBAT > VMSTR+ or by connecting charger and charging the battery above VMSTR+.
- Acting Dead: If the phone is off when the charger is connected, the phone is powered on but enters a state called "Acting Dead". To the user, the phone acts as if it was switched off. A battery charging alert is given and/or a battery charging indication on the display is shown to acknowledge the user that the battery is being charged.
- Active: In the Active mode the phone is in normal operation, scanning for channels, listening to a base station, transmitting and processing information. There are several sub-states in the active mode depending on if the phone is in burst reception, burst transmission, if DSP is working etc.

  In Active mode the RF regulators are controlled by SW writing into UEMCLite's registers wanted settings: VR regulators can be disabled, enabled or forced into low quiescent current mode. VR2 is always enabled in Active mode for system clock chain supply
- Sleep: In sleep mode VCTCXO is shut down and 32 kHz sleep clock oscillator is used as reference clock for the base band.
- Charging: Charging can be performed in any operating mode. The battery type / size is indicated by a resistor inside the battery pack. The resistor value corresponds to a specific battery capacity. This capacity value is related to the battery technology as different capacity values are achieved by using different battery technology. The battery voltage, temperature, size and current are measured by the UEMCLite and controlled by the charging software running in the UPP. The charging control circuitry (CHACON) inside the UEMCLite controls the charging current delivered from the charger to the battery. The battery voltage rise is limited by turning the UEMCLite switch off when the battery voltage has reached 4.2 V. Charging current is monitored by measuring the voltage drop across a 220 mW resistor. The PWM output doesn't exist any more from UEMCLite to the bottom connector

Voltage limits

Table 7 Voltage limits

Parameter	Description	Value/V
Vmstr+	Master reset threshold (rising)	2.1 ±0.1
Vmstr-	Master reset threshold (falling)	1.9 ±0.1
Vcoff+	Hardware cutoff (rising)	3.1 ±0.1
Vcoff-	Hardware cutoff (falling)	2.8 ±0.1
SW shutdown	SW cutoff limit (> regulator drop-out limit) MIN!	3.2 V

Audio function description

The basic audio structure and communication between HW-audio modules and the audio ASIC's is illustrated in the block diagram below.

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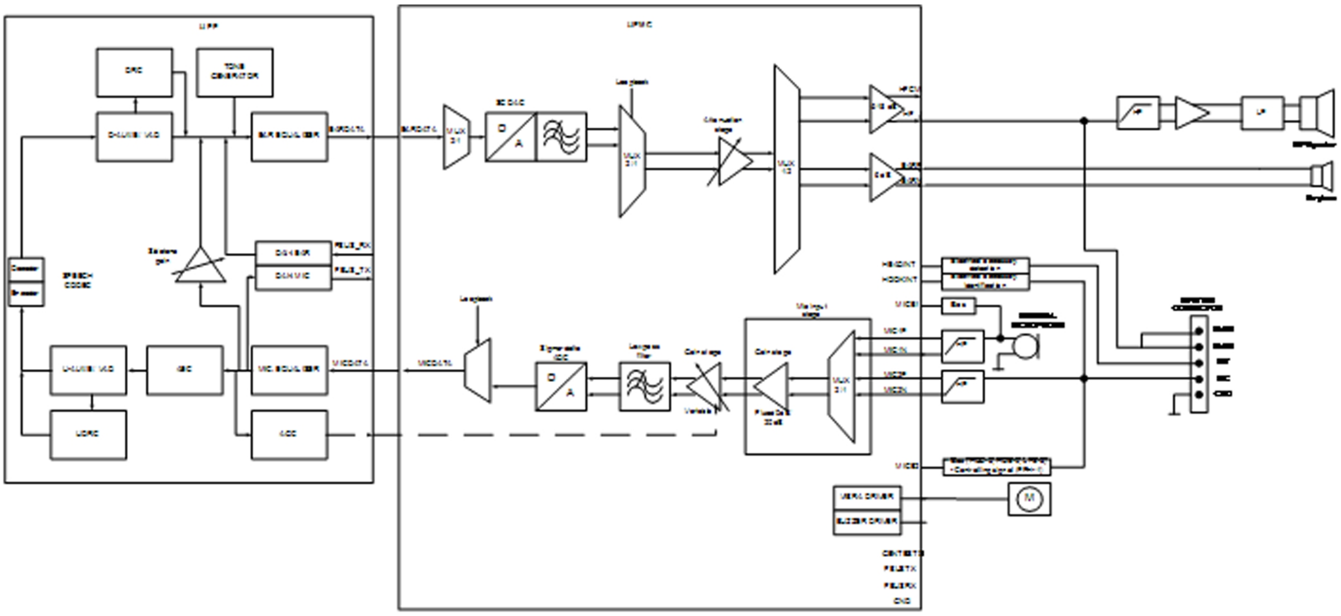

Figure 85 Audio block diagram

UEMcLite supports three microphone inputs and two outputs. The inputs can be used for internal, headset or handsfree microphones. The microphone signals from different sources are connected to separate inputs at the UEMcLite ASIC. The inputs and outputs are all differential.

Three inputs (MIC1, MIC2) and two outputs (EAR, HF) are used in the phone.

MIC1P/MIC1N inputs are used for the internal microphone, using single-ended biasing circuitry. EARP/EARN outputs from UEMcLite are used for hand-portable mode.

Uplink external audio (headset as well as carkit) is connected to MIC2P/MIC2N, while downlink audio is provided via the HF outputs from UEMcLite. A special situation exists since the carkit can be used with two different microphones: either the phone's internal microphone (MIC1-inputs) or an external microphone that connects to the carkit. In these cases UEMcLite is capable of switching between MIC1 and MIC2.

The audio control is taken care of by UEMcLite, which contains the MCU and audio codec. UPP contains DSP blocks, and handling and processing of the audio signals.

Input and output selection, and gain control is performed inside UEMcLite. DTMF-tones and other audio tones are generated and encoded by UPP and transmitted to UEMcLite for decoding.

External audio connector

The system connector, containing a 4-pole Jack plug, gains the access to the external audio interface. The Jack plug, which is integrated in the system connector, contains a mechanical switch, which is used to detect the connection of the accessories. The configuration for the 4-pole Jack-plug is shown in the following figure.

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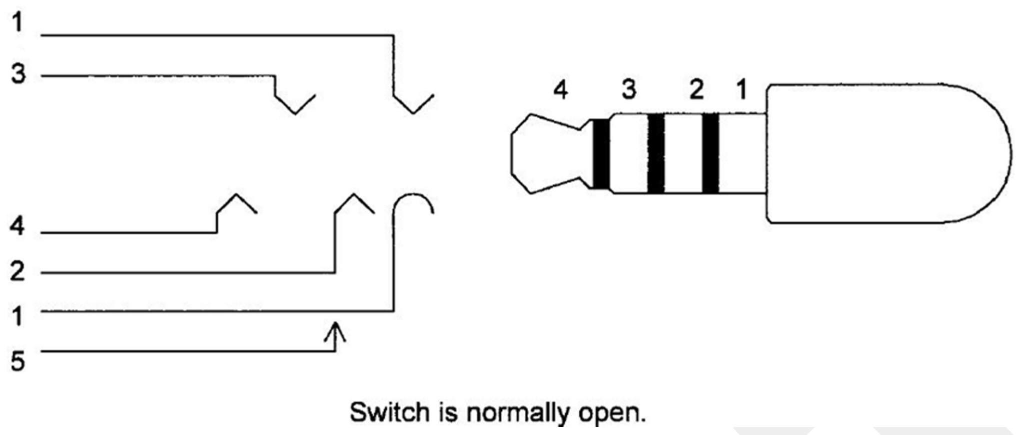

Figure 86 4-pole jack plug for audio accessory

Table 8 Connector for External Audio Accessories

Pin	Signal name	Direction	Description
5	PLUGDET	Input	Terminal internal connection, plug detection
4	HS EAR L	Output	Audio output
3	HS EAR R	Output	Audio output
2	HS MIC	Input	Multiplexed microphone audio and control data
1	HS GND	-	Ground contact

HALL sensor

The HALL sensor is used to recognize the position of the flap.

The HALL sensor incorporates advanced chopper-stabilization techniques to provide accurate and stable magnetic switch points. The circuit design provides an internally controlled clocking mechanism to cycle power to the HALL element and analog signal processing circuits. This serves to place the high current-consuming portions of the circuit into the sleep mode. Periodically the device is awakened by this internal logic and the magnetic flux from the HALL element is evaluated against the predefined thresholds. If the flux density is above or below the BOP/BRP thresholds, the output transistor is driven to change states accordingly. While in the sleep cycle, the output transistor is latched in its previous state.

The output transistor of the SH248CSP is latched on at the presence of a sufficiently strong south or north magnetic field facing the marked side of the package. The output is latched off in the absence of a magnetic field.

The output of hall sensor is sent to GENIO24 of UPP. Baseband knows the status of the hall sensor that represents the phone position (folded or not).

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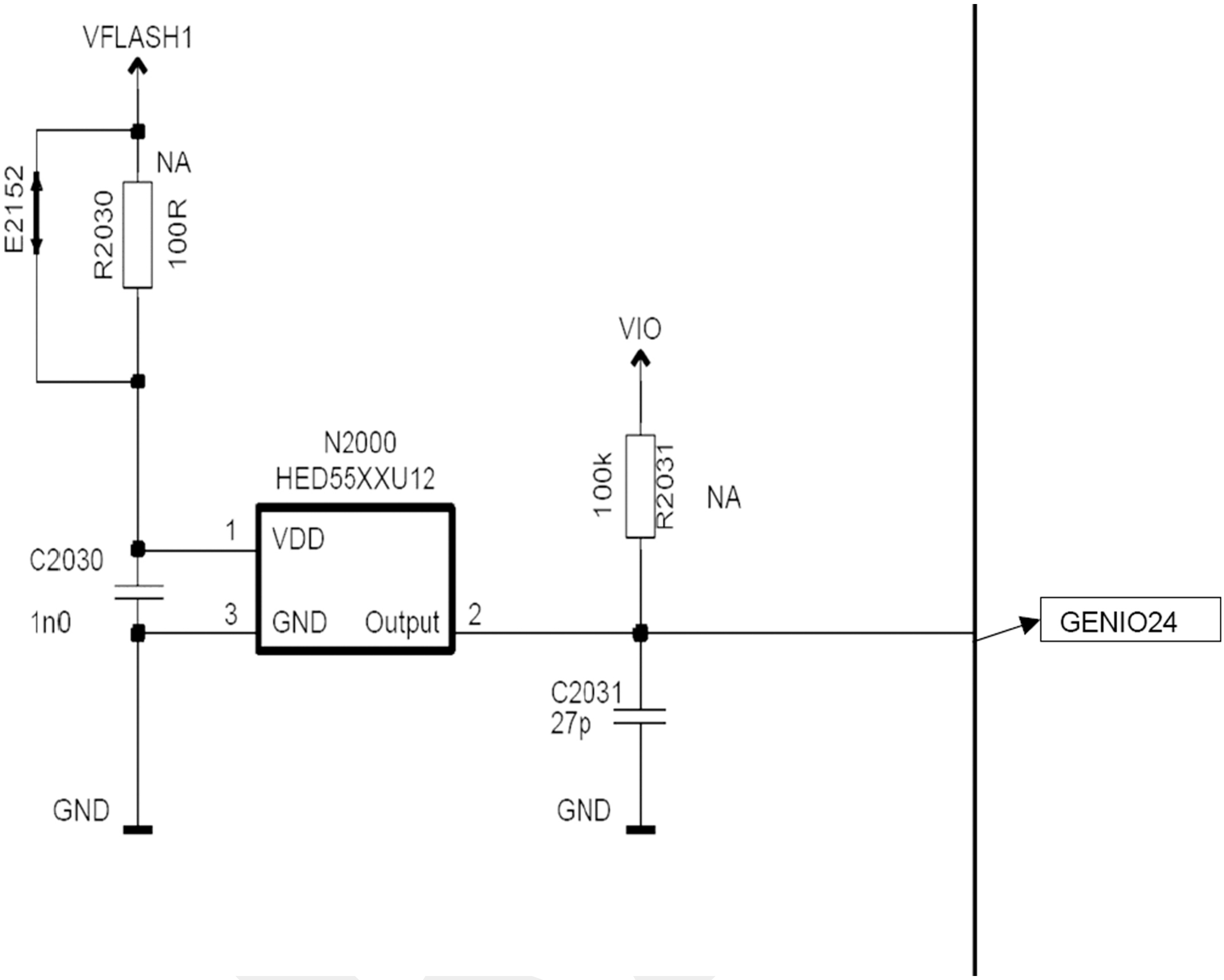
VFLASH1
E2152
R2030
NA
100R
VIO
N2000
HED55XXU12
100k
R2031
NA
C2030
1n0
1
VDD
3
GND
Output
2
GENIO24
C2031
27p
GND
GND

Figure 87 HALL sensor

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Interfaces

RF and baseband interfaces

Table 9 AC and DC Characteristics of BB4.0 LiteV2 RF-Base band Digital Signals

Signal name	From	To	Para-meter	Input characteristics				Function
				Min	Typ	Max	Unit	
TXP1	UPP	RF-IC	1	1.38		1.88	V	Depends of the RF design
RFGenOut3	GenIO5		0	0		0.4	V	
			Load Resistance	10			kW	
			Load Capacitance			20	pF	
			Timing Accuracy			¼	symbol	
TXP2	UPP	RF-IC	1	1.38		1.88	V	Depends of the RF design
	(GenIO6)		0	0		0.4	V	
			Load Resistance	10			kW	
			Load Capacitance			20	pF	
			Timing Accuracy			¼	symbol	
RFBusEn1X	UPP	RF-IC	1	1.38		1.88	V	RFIC Chip SelX
			0	0		0.4	V	
			Internal PU Current			50	uA	
			Load resistance	10			kW	
			Load capacitance			20	pF	

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Signal name	From	To	Para-meter	Input characteristics				Function
				Min	Typ	Max	Unit	
RFBusDa	UPP / RF-IC	RF-IC/ UPP	1	1.38		1.88	V	Bi-directional RF Control serial bus data,
			0	0		0.4	V	
			Load resistance	10			kW	
			Load capacitance			20	pF	
			Data frequency			13	MHz	
RFBusClk	UPP	RF IC	1	1.38		1.88	V	RF Control serial bus bit clock
			0	0		0.4	V	
			Load resistance	10			kW	
			Load capacitance			20	pF	
			Data frequency			13	MHz	
GENIO3	UEMCLite	RF IC	1		2.78		V	RF Control *
			0				V	Depends of the RF design
			Load resistance				kW	
			Output current			4	mA	
GENIO4	UEMCLite	RF IC	1		2.78		V	Audio clock input in UEMCLiteV3 and LittiV2
			0				V	
			Load resistance				kW	
			Output current			4	mA	
GENIO5	UEMCLite	RF IC	1		2.78		V	RF Control *
			0				V	Depends of the RF design
			Load resistance				kW	
			Output current			4	mA	

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Analogue Signals

Table 10 AC and DC Characteristics of RF-Base band Analogue Signals

Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
RFCLK	VCTCXO	UPP	Frequency		13/26		MHz	System Clk from RF to BB,
			Signal amplitude	0.2	0.8	1.32	Vpp	13/26 MHz Depending on RF chipset
			Input Impedance	10			kW	UPP minimum recommended amplitude is 0.3Vpp.
			Input Capacitance			10	pF	
			Harmonic Content			-8	dBc	
			Clear signal window (no glitch)	200			mVpp	
			Duty Cycle	40		60	%	
RFCLKGnd	VCTCXO	UPP	DC Level		0		V	System Clock slicer Ref GND, not separated from pwb GND layer
RXIP, RXIN, RXQP, RXQN	RF-IC	UEMCLite	Voltage swing (static)		1.4	1.45	Vpp	Differential positive / negative in-phase and quadrature Rx Signals.
			DC level	1.3	1.35	1.4	V	
			I/Q amplitude mismatch			0.2	dB	
			I/Q phase mismatch	-0.5		0.5	deg	
TXIP, TXIN, TXQP, TXQN	UEMCLite	RF-IC	Differential voltage swing (static)	2.25		2.45	Vpp	Differential positive / negative in-phase and quadrature Tx Signals In High-Z when RX is receiving.
			DC level	1.17	1.20	1.23	V	
			Source Impedance			200	W	

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Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
AFC	UEMCLite	VCTCXO	Voltage Min	0.0		0.1	V	Automatic Frequency Control signal for VCTCXO Programmable
	(AFCOUT)		Max	2.4		2.55		
			Resolution	11			bits	
			Load resistance	1			kW	
			and capacitance			100	nF	
			Source Impedance			200	W	
			Output impedance	10			MW	Path powered down
TxC	UEMCLite	RF-IC	Voltage Min			0.1	V	Transmitter power level and ramping control, Ref UEMCLite RF converter specification
	(AUXOUT)		Max	2.4				
			Source Impedance			200	W	
			Resolution	10			bits	
VCXOTEMP	RF-IC	UEMCLite	Input voltage range	0		2.7	V	
			Input resistance	900		6000	Ohm	
			Resolution	10			bits	
PATEMP	RF-IC	UEMCLite	Voltage at -20oC		1.57		V	Usage depends of the RF design

LCD interface

The display is controlled by phone processor UPP.

The LCD module is connected to PWB by a 2KB UI flex.

Keyboard

A 5 X 5 matrix keyboad consists of 21 keys, one 10-channel integrated passive filiter arrays with downstream ESD protection of >8KV connect the matrix keyboard to UPP.

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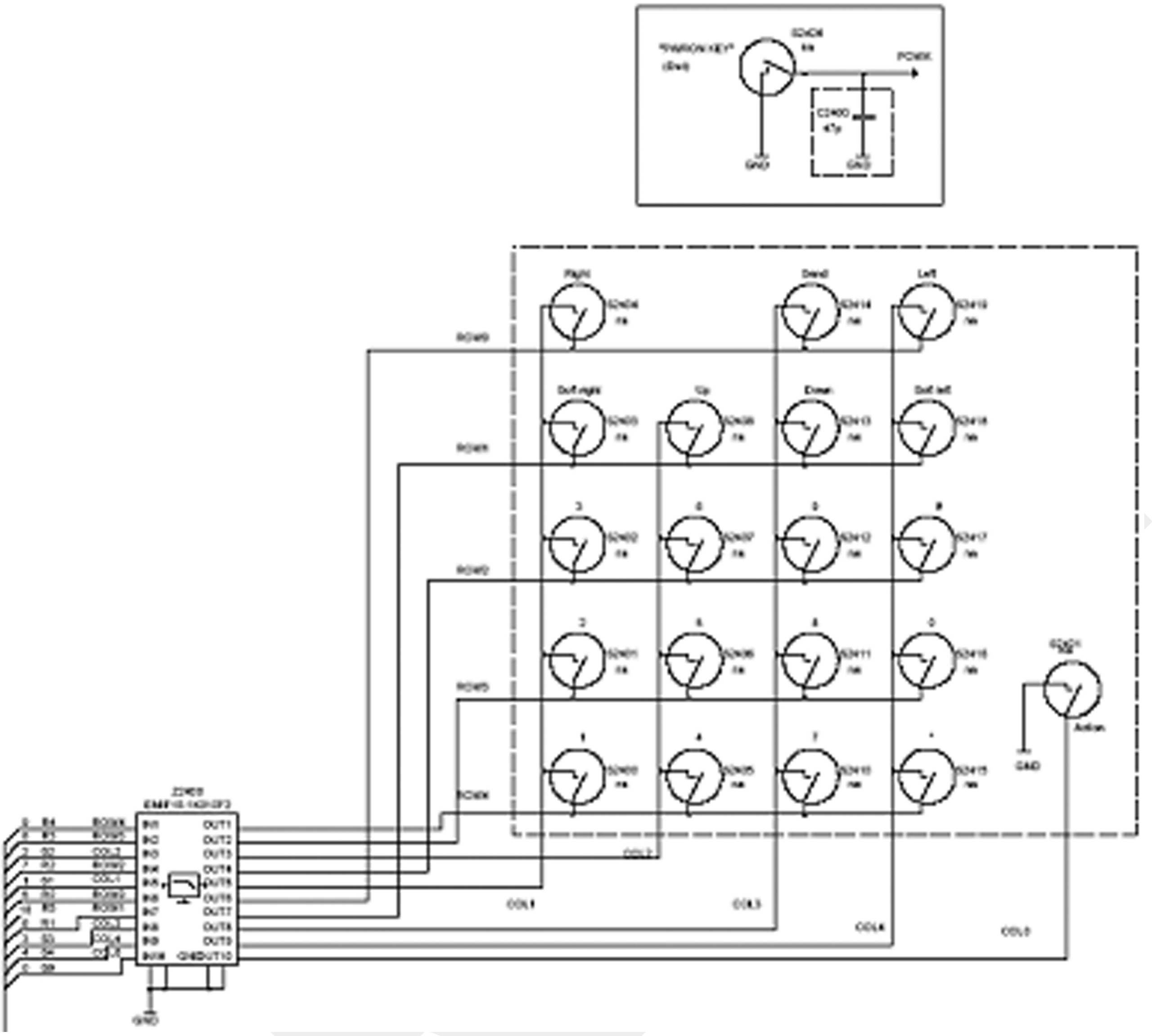
"POWER KEY"
POWER
GND
GND
Right
Send
Left
Soft right
Up
Down
Soft left
Action
GND
ROW0
ROW1
ROW2
ROW3
ROW4
COL1
COL2
COL3
COL4
COL5
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
OUT8
OUT9
GNDOUT10
GND

Figure 88 Keyboard schematics

The layout is shown in Keyboard layout in UI side.

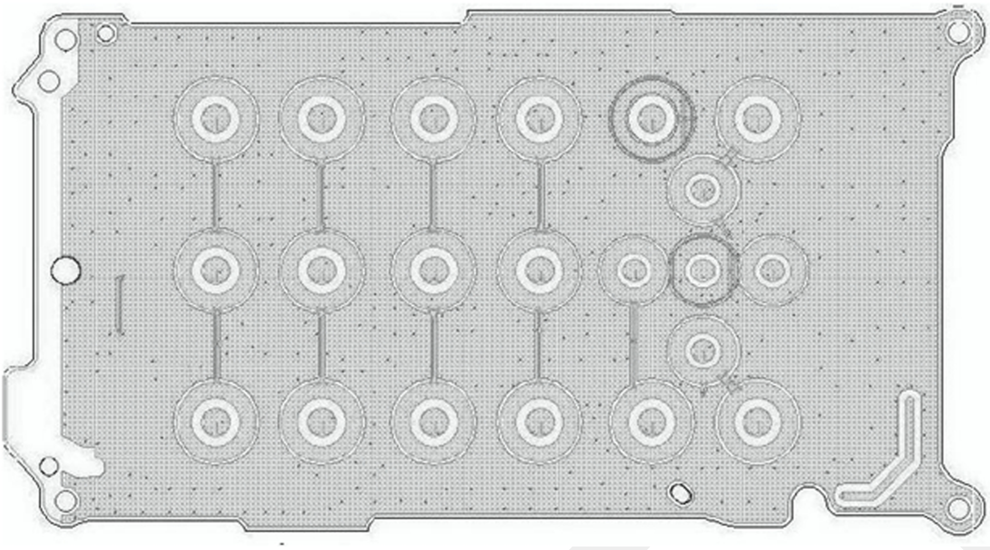

Figure 89 Keyboard layout in UI side

SIM interface

The UEMCLite contains the SIM interface logic level shifting. The SIM interface can be programmed to support 3V and 1.8V SIMs. SIM supply voltage is selected by with register in the UEMCLite. It is only allowed to change the SIM supply voltage when the SIM IF is powered down.

The SIM power up/down sequence is generated in the UEMCLite. This means that the UEMCLite generates the RST signal to the SIM. In addition, the SIMCardDet signal is connected to UEMCLite. The detection is taken from the BSI signal, which detects the removal of the battery. The monitoring of the BSI signal is done by a comparator inside UEMCLite. The comparator offset is such that the comparator outputs do not alter state as long as the battery is connected. The threshold voltage is calculated from the battery size specifications.

The SIM interface is powered up when the SIMCardDet signal indicates "card in". This signal is derived from the BSI signal.

Table 11 SIM interface

Pin	Name	Parameter	Min	Typ	Max	Unit	Notes
4	DATA	1.8V Voh	0.9xVSIM		VSIM	V	SIM data (output)
		1.8V Vol	0		0.15xVSIM		
		3V Voh	0.9xVSIM		VSIM		
		3V Vol	0		0.15xVSIM		
		1.8V Vih	0.7xVSIM		VSIM	V	SIM data (input)
		1.8V Vil	0		0.15xVSIM		Trise/Tfall max 1us
		3V Vil	0.7xVSIM		VSIM		
		3V Vil	0		0.15xVSIM		
5	NC						Not connected
6	GND	GND	0		0	V	Ground

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Pin	Name	Parameter	Min	Typ	Max	Unit	Notes
VSIM specified in regulator section in this document							

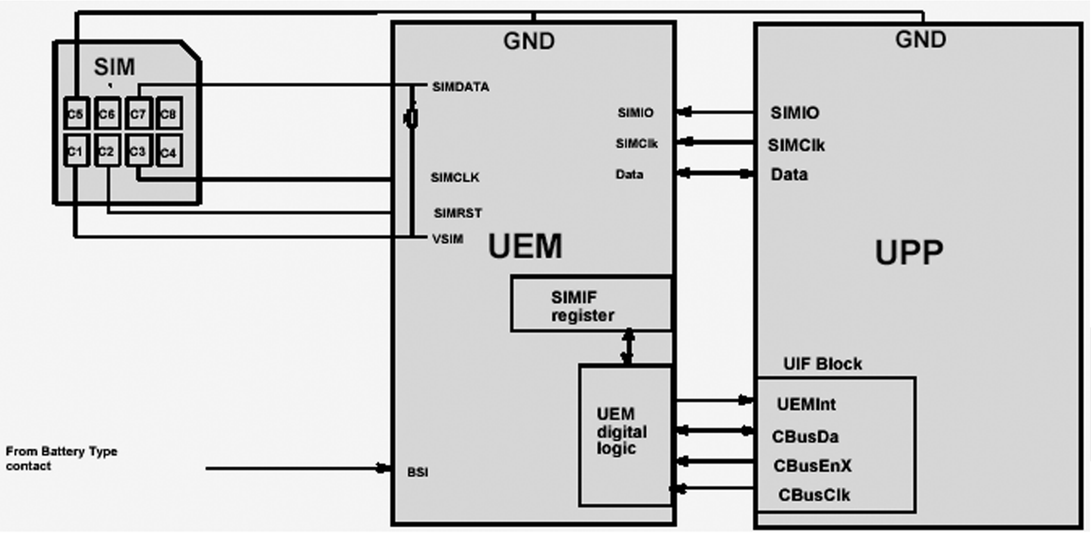
SIM
C5
C6
C7
C8
C1
C2
C3
C4
GND
SIMDATA
SIMCLK
SIMRST
VSIM
UEM
SIMIO
SIMClk
Data
SIMIF register
UEM digital logic
BSI
From Battery Type contact
GND
SIMIO
SIMClk
Data
UPP
UIF Block
UEMInt
CBusDa
CBusEnX
CBusClk

Figure 90 SIM interface block diagram

External signals and connections

Table 12 System connector

Signal	From	To	Min	Nom	Max	Condi-tion	Note
XMICP	HS/HF Mic	UEMC Lite		2/60mV diff		Analog audio in	Headset Mic bias and audio signal 2mV nominal. HF Mic signal 60mV nominal. Differential symmetric input.
						DC bias 2V2kohm	Accessory detection by bias loading
XMICN				2/60mV diff		Ana in / 1k to GND	Hook interrupt by heavy bias loading
XEARP	HS/HF	UEMC Lite		100 mV diff		Ana in	Quasi-differential DC-coupled earpiece/HF amplifier signal to accessory. DC biased to 0.8V
XEARN	EAR/ Amp.						
INT HEADINT	Switch	UEMC Lite		0/2.7V		Dig in	HS interrupt from bottom connector switch when plug inserted.

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Signal	From	To	Min	Nom	Max	Condi-tion	Note
VCHARIN	Charger	UEMC Lite		11.1Vpeak	16.9 Vpeak	Standard	Vch from Charger Connector, max 20V
					7.9 VRMS		
					1.0 Apeak		
			7.0 VRMS	8.4 VRMS	9.2 VRMS	Fast charger	
					850 mA		
GND					GND		GND from/to Charger connector

Battery connector

Table 13 Battery IF

Signal	From	To	Min	Nom	Max	Note
GND	Global	Batt (-)				Global GND
VBAT		Batt (+)	3.1		5.1	Battery Voltage
BSI		UEMCLite	0		2.78	Analog input, Battery Size Indicator Resistor, 100 kohm pull up to 2.78V (VBB1). FDL Init, refer to flash download.

Battery interface

- Type: BL-4B
- Technology: Li-Ion, 4.2 V charging, 3.1 V cut-off
- Capacity: 700 mAh.

BL-4B has a 3 pin interface with overcharge / discharge protection (safety circuit) and battery size indication BSI with an internal resistor. The BSI fixed resistor value indicates type and default capacity of a battery.

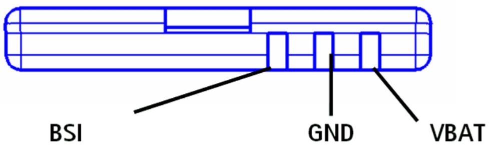

Figure 91 BL-4B battery pack contacts

Table 14 Pin numbering of battery pack

Signal name	Pin number	Function
GND	2	Negative/common battery terminal

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Signal name	Pin number	Function
BSI	3	Battery capacity measurement (fixed resistor inside the battery pack)
VBAT	1	Positive battery terminal

PWB outline

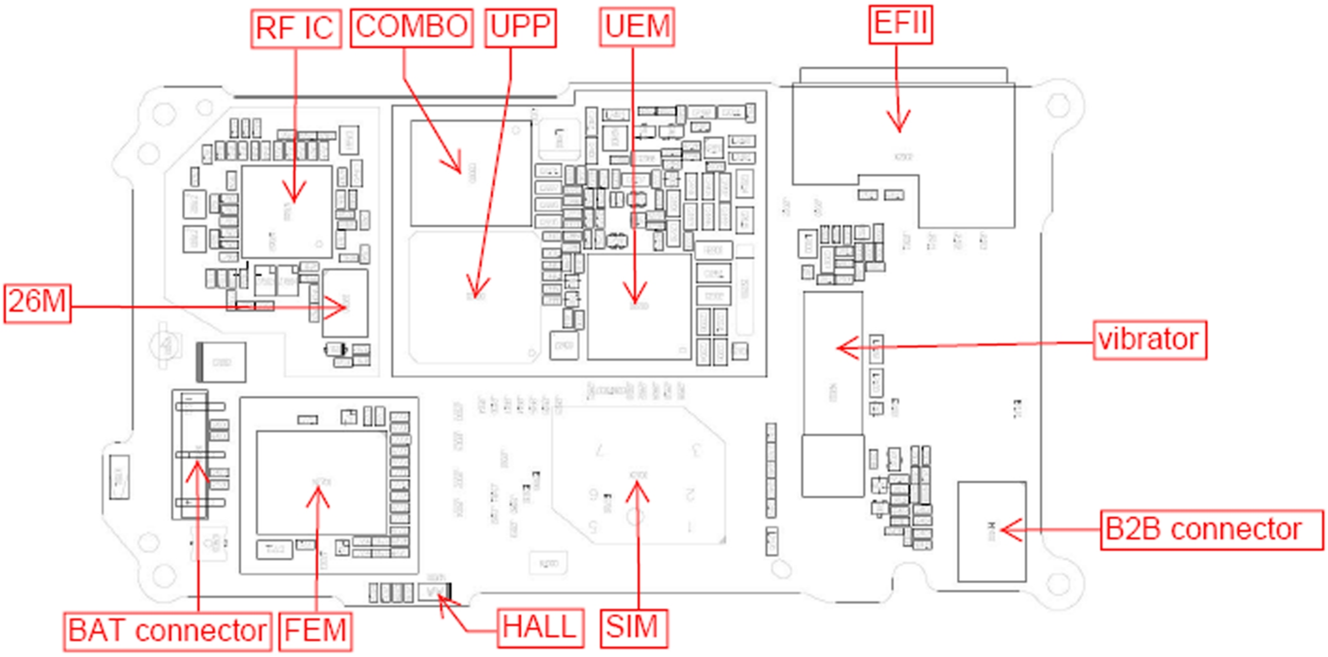
RF IC
COMBO
UPP
UEM
EFII
26M
vibrator
B2B connector
BAT connector
FEM
HALL
SIM

Figure 92 PWB top side component placement

RF description

Frequency band, power and multi-slot class

The requirement leads to the specification in the table below:

Table 15 Frequency bands and TX power class

System	Frequency band	TX power class
GSM900	Tx: 880 – 915 MHz	4 (33dBm)
	Rx: 925 – 960 MHz	
GSM1800	Tx: 1710 – 1785 MHz	1 (30dBm)
	Rx: 1805 – 1880 MHz	

Table 16 Multi-slot class

Multislot Class	
GPRS	MSC 10 (4Dn/2Up), sum=5

Multislot Class	
E-GPRS	MSC 6 in DL, max. 3Dn

Transmitter - general description

The transmitter has separate, parallel paths covering the different bands. The transmitter operates in GMSK mode only. The power level control circuitry is integrated in the front-end module.

Each path of the transmitter is composed of a baseband lowpass filter for the I/Q signals and a quadrature direct modulator integrated in PMB3258. At the modulator's output there is a bandpass filter for each band (so-called H3 filter) and a balun transformer to convert the differential output signal from the modulator into a single-ended 50 ohm signal. This signal is fed into the input of the PA. The two power amplifiers and the antenna switch are integrated in a single module with built-in power control loop.

The two control methods used are open-loop Vcc control (RFMD) and feedback control with current sensing. The reference waveform (TXC) for the control loop comes from the baseband. The output of the PA goes into a low pass filter located inside the FEM (Front End Module). Finally the transmit signal goes through the band selection and TX/RX switches to the antenna port.

The FEM is controlled with four digital control signals (TXP, Vc1, Vc2 and Vc3) to meet the TDMA frame timing requirements.

Transmitter - signal processing

The I/Q signals coming from the baseband section are fed into the modulator and converted up to the carrier frequency. The I/Q are post filtered by a 1st order passive RC filter (discrete components on PWB) and a 3rd order active filter (Legendre type) inside PMB3258.

The nominal output level of the modulator is +3.5 dBm in both bands. The modulator's output is an open-collector type and need an external load and a DC supply feed. The load and the DC supply feed are implemented as the part of the H3 filter.

The filtered signal is fed into the input of the FEM, which amplifies it to the desired power level and provides the signal at the antenna port.

There is also a temperature sensor close to the FEM to enable SW temperature compensation for e.g. the power levels. The sensor is connected to one of the slow ADC channels in the baseband.

Receiver - general description

The receiver is a direct conversion linear receiver. It is a dual-band receiver with receiver paths for either GSM850/1900 or GSM900/1800 configuration.

From the antenna, the received RF-signal is fed into the front-end module, which routes the signal to the appropriate RX path. After the FEM, the RX signals are filtered by SAW filters (one for each band), which reject the out-of band blocking signals to low enough level to be handled by the RF ASIC.

There are two paths – one for each band. In each path, the signal is then fed to the low noise amplifier (LNA). One LNA can handle both the GSM850 and GSM900 signals and another is used for GSM1800 and GSM1900. The LNA inputs are matched to the SAW filter outputs by means of discrete LC matching networks. The SAW filters and the matching networks are different for different band combinations, but the PWB layout is the same for both 850/1900 and 900/1800 versions.

The RX front-end circuitry contains the LNA and the quadrature down converting mixers. The front-end gain is programmable so that the gain can be reduced in strong-signal conditions. The mixers at each signal path convert the RF signal directly down to baseband I/Q signals. Local oscillator signals for the mixers are generated by an on-chip VCO.

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The output signals (I/Q) of each demodulator are all differential. They are combined to two differential signal paths, one for I-channel and one for Q-channel, common for all bands. The baseband RX signals are then fed into a 3rd order active blocking filter, which has programmable gain. One of the three poles is implemented by an off-chip capacitor connected directly between the mixer outputs. There are a total of two off-chip capacitors, one for I-channel and one for Q-channel, respectively.

After the blocking filter, the signal is fed into a buffer amplifier, which also has programmable gain. Around the amplifier there is the first DC-offset compensation block, which removes most of the cumulated DC offset so far. The DC offset compensation method is based on digital successive approximation technique.

The next block in the RX chain is a switched-capacitor (SC) channel filter, which provides the close-in selectivity for the analog receiver. Because the SC-filter is insensitive to the IC process tolerances, no production calibration of the filter is necessary. The SC-filter operates on 6.5 MHz clock, which is generated by dividing the 26 MHz reference clock by four.

After the SC-filter there is a continuous-time smoothing filter which attenuates the alias signals generated by the sampling process inherent in the SC-filter. The smoothing filter also has programmable gain.

The next block is a programmable gain amplifier (PGA), which has the second DC-offset compensation block around it. The DC-offset compensation method is again based on digital successive approximation technique.

The last block in the analog receiver is an output buffer amplifier, which feeds the differential I/Q signals off-chip to be A/D converted in the digital baseband.

VCXO and PLL

The VCO frequency is locked by a PLL (phase locked loop) into a stable frequency source given by a VCXO. The frequency of the VCXO is in turn locked into the frequency of the base station with the help of an AFC (automatic frequency control) voltage, which is generated in the UEM. The reference frequency is 26 MHz.

The VCXO also provides a 26 MHz system clock for the digital baseband.

The PLL is located in PMB3258 and it is controlled via the RFBUS.

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Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

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DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared

IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency

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RF PopPort™	Reduced function PopPort™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator

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VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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